

For Tom

if possible

A SEMANTIC STUDY OF THE CLASSIFIER ZHANG *

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1. Introduction

Categorization is a fundamentally important aspect of human cognition, and categorization of some sort is obviously involved in classifier systems. It is not immediately clear, however, if classifier systems are merely arbitrary, overt systems of linguistic categorization without underlying conceptual structures, or if they actually reflect conceptual structures and thus are indicative of human categorization.

For Chinese, Tai and Wang (1990), Tai (1992), and Tai (1994) have demonstrated that the classifiers in the language, to a great extent, reflect human categorization in the culture. Thus, the Chinese classifier system provides a wealth of data for our better understanding of human categorization. Whereas Tai and Wang (1990) investigate the conceptual structure of the classifier *tiao* 条, this paper will examine the conceptual structure of *zhang* 张.

Both *tiao* and *zhang* are shape-based classifiers. While *tiao* is used for long objects, *zhang* is used for flat objects. In terms of geometric abstraction, long objects are extended in one dimension, flat objects in two dimensions, and round objects in three dimensions (cf. Allan 1977). We can go one step further by assuming that the extension in one, two, and three dimensions is the primary cognitive basis for shape classifiers; other cognitive features such as flexibility, rigidity, and discreteness are secondary parameters (cf. Adams and Conklin 1973). On this view, *tiao*, one dimension in extension, is 'primary' among the group of classifiers for long objects that also include *gen* 根 and *zhi* 枝; and *zhang* is 'primary' among the group of Chinese classifiers for flat objects that also include *fu* 幅, *pian* 片, and *mian* 面. In this paper, we will examine the conceptual structures of the *zhang* family of classifiers, focussing on *zhang*, the central member.

Our analysis of *zhang* in this paper is a sequel to Tai and Wang's analysis of *tiao* in this journal. More importantly, our analysis is based on the same theoretical foundation as the earlier study. First, the prototype theory of

categorization is adopted. In this theory, the formation of a category can be achieved through association with the prototypes, and this association can be sanctioned by either perceptual features such as shape and size, or functional features such as those for the categories of furniture and tools. Second, a non-objectivist, experiential view of categorization is assumed. On this view, human experience and imagination play a crucial role in association for the formation of a category. Third, data pertaining to the historical development of classifiers are used for the construction of their conceptual structures.

The remainder of the paper is organized as follows: in section 2, we propose a categorical structure for the classifier *zhang* in the spirit of the prototype theory, but also take into consideration the developmental history of *zhang*; section 3 examines the other members of the *zhang* family, and section 4 concludes the paper.

2. The Categorical Structure of the Classifier *Zhang* 张

Before presenting our analysis of *zhang*, its historical development will be outlined first, based on two main sources. These are the historical data documented by Liu (1965) and Erbaugh's (1985) historical analysis and synthesis of previous works on the development of Chinese classifiers. The word *zhang* was originally a verb meaning 'to draw a bow.' By the Eastern Han dynasty (106 B.C. - 25 A.D.), it had become a classifier first for bows and tents, and then for Chinese zithers, which were made out of bows with strings to be plucked. By the Tang dynasty (618-907 A.D.), its use as a classifier was extended first to paper and then to paintings. By the Song dynasty (960-1117 A.D.), it was further extended for flat things in general, and to tables and flags in particular.

The historical development of *zhang* provides us with a basis for constructing its categorical structure in modern Chinese. In the following, we propose a prototype theory for the classifier *zhang* in the modern language, consisting of the following four subgroups: (1) prototypes consisting of objects with strings to be stretched, such as bows, zithers, and plows; (2) the first extension for spreadable objects, such as nets and tents; (3) the second extension for flat things that can be rolled up, such as paper and skin; and (4) the third extension for objects with flat tops, such as beds and tables.

2.1. *Zhang* as a Verb

As annotated in *Shuowen*, the original meaning of *zhang* was 'to draw a bow.' This verbal meaning of *zhang* can still be discerned from the graph, with 弓 *gong* 'bow' as the semantic component. In modern Chinese, *zhang* continues to be used as a verb with the basic meaning of 'to stretch': *zhang gong* 张弓 'to draw a bow', *zhang wang* 张网 'to spread a net', and *zhang zui* 张嘴 'to open one's mouth.' It also occurs in verb compounds, such as *zhang kai* 张开 'to open.' A careful examination of the history of *zhang* shows that it has never been used as a noun, except in its function as a classifier and as a family name.

It is worth noting that the verbal origin of *zhang* presents a notable exception to the generalization of the nominal origin of classifiers (cf. Denny 1976, Craig 1985, Lee 1988).

2.2. Prototypes of *Zhang*

The historical development of *zhang* indicates that in its inception as a classifier, it was used to refer to objects with stretchable strings. We therefore treat those nouns that refer to stretchable objects as the prototypes in modern Chinese. For example,

1) yi zhang gong	一张弓	'a bow'
yi zhang li	一张犁	'a plow'
yi zhang guqin	一张古琴	'a Chinese zither'

As in drawing a bow, the strings of a plow is stretched in plowing. Similarly, a zither's strings are stretched when plucked in playing. Plucking the strings of a instrument is similar to drawing a bow: both actions involve stretching some strings.

Note that among the stringed musical instruments, only *guqin* 'Chinese zither' uses the classifier *zhang*. For those stringed musical instruments that have a handle, as in the cases of *jita* 吉他 'guitar', *pipa* 琵琶 'plucked string instrument', and *erhu* 二胡 'two-stringed bowed instrument', the classifier *ba* 把 'handle' is used. Clearly, the choice of *ba* reflects the handle as the salient feature for these objects, just as it is for other portable objects with a handle, such as *daozi* 刀子 'knife' and *san* 伞 'umbrella.' By the same token, the classifier *jia* 架 'stand' is used for those musical instruments that is on a stand or rests on one. These include *guzheng* 古筝 '21- or 25- stringed plucked instrument', *yangqin* 洋琴 'dulcimer', and *gangqin* 钢琴 'piano', which are

categorized with *jiqi* 机器 'machine', *feiji* 飞机 'airplane', and other objects on a stand or support. The above provide ample evidence that musical instruments in Chinese are classified according to their salient features, and that these features are localized in a part of the instrument that became salient through human interaction with the instrument.

2.3. First Extension of Zhang

In modern Chinese, *zhang* is also used for objects that are made with ropes or have ropes as a component, and these ropes need to be spread out for these objects to be used. Listed below are some examples.

- | | | |
|--------------------|------|----------|
| 2) yi zhang wang | —张网 | 'a net' |
| yi zhang fan | —张帆 | 'a sail' |
| yi zhang zhangpeng | —张帐篷 | 'a tent' |

We treat this group as the first extension of *zhang* from its prototype use in (1) because the objects involved have ropes (rather than strings) that need to be stretched out for the objects to be used. However, objects in this extended group differ from the prototypes in one important respect; namely, they form a flat surface when spread out. The prototype objects stretch out strings between two pivotal points but do not form a flat surface.¹

2.4. Second Extension of Zhang

In modern Chinese, *zhang* are used for thin and flat objects. We treat this use as the second extension of *zhang*. Key examples are given below.

- | | | |
|---------------------|-------|----------------------------|
| 3) yi zhang doufupi | —张豆腐皮 | 'a skin of soya-bean milk' |
| yi zhang dabing | —张大饼 | 'a pancake' |
| yi zhang cipian | —张磁片 | 'a phonograph record' |
| yi zhang heye | —张荷叶 | 'a lotus leaf' |
| 4) yi zhang zhi | —张纸 | 'a sheet of paper' |
| yi zhang hua | —张画 | 'a painting' |
| yi zhang biantiao | —张便条 | 'a note' |
| yi zhang biaoge | —张表格 | 'a form (to fill in)' |
| yi zhang baozhi | —张报纸 | 'a newspaper' |
| yi zhang youpiao | —张邮票 | 'a stamp' |

In two respects, members of the second extension are different from those of the first extension. First, they do not have strings or ropes to spread out.

Second, they are thin, with a flat surface as their default natural shape, even though many of them can be rolled up. In contrast, members of the first extension need to be spread out to obtain a flat surface.

We have grouped those thin objects made of paper in (4), with the implication that *zhi* 纸 'paper' could be further construed as the prototype for this group of objects. This means that it is possible to have core members within each layer of the extended category.

It is noteworthy that *dabing* 大饼 'pancake' in Chinese can be a kind of large flatbread as well as a kind of thick cake. The classifier *zhang* is used only for the flatbread; it is not used for the thick cakes, which take the classifier *kuai* 块 'lump.' This difference in usage exists because the salient, conceptual feature of *zhang* is two-dimensionality, whereas that of *kuai* is three-dimensionality. Similarly, while *zhang* is often used for the 5-1/4" *cipian* 磁片 'diskettes,' which have a very thin, flat shape, the classifier *kuai* is used for the thicker, bulkier 3-1/2" *cipian*.

A pattern also emerges with the distribution of *zhang* versus *pian* 片 'piece.' With respect to leaves, for example, *zhang* is used with those leaves that are large, such as *heye* 荷叶 'lotus leaf,' *zongye* 棕叶 'palm leaf,' and *bajiao ye* 芭蕉叶 'banana leaf,' while *pian* is used as a classifier for *chaye* 茶叶 'tea leaf,' *rongsyuye* 榕树叶 'banyan leaf,' and other kinds of leaves that are small in size. For the same reason, while the classifier *zhang* is used for whole sheets of paper, the classifier *pian* is used for small pieces of paper.

2.5. Third Extension of Zhang

The classifier *zhang* is also used for nouns denoting three-dimensional objects with a flat surface on the top. This group of nouns can be exemplified below.

- | | | |
|--------------------|------|-------------|
| 5) yi zhang chuang | —张床 | 'a bed' |
| yi zhang zhuozi | —张桌子 | 'a table' |
| yi zhang yizi | —张椅子 | 'a chair' |
| yi zhang dengzi | —张凳子 | 'a stool' |
| yi zhang guitai | —张柜台 | 'a counter' |

This group can be treated as the third extension of *zhang* from its use for thin and flat objects, which are inherently two-dimensional in configuration. The objects denoted by the group of nouns in (5) are three-dimensional in configuration. However, as the flat tops on which human activities take place

are two-dimensional, the salient perceptual feature picks up the two-dimensionality of their flat surfaces.

It should be noted that *dengzi* 凳子 by itself can mean either 'a stool' or 'a bench.' For a stool, we use the classifier *zhang*, and for a bench, we use *tiao*. The choice of *tiao* for benches indicates that the long shape of a bench is treated as its salient feature and not its flat surface. We do not have an explanation for why, in this case, one-dimensionality overrides two-dimensionality. A different situation holds in the case of *yizi* 椅子 'chair,' which is used with *zhang* as well as the classifier *ba* 把 'handle.' A chair has a back and/or arms for our hands to grasp. The back and arms are thus analogous to the handle of an object. The fact that both *zhang* and *ba* can be used for *yizi* shows that the two salient features in question compete with each other.² Similarly, both *zhang* and *ge* 个 can be used with *shafa* 沙发 'sofa.'

2.6. Zhang for Body Parts

The classifier *zhang* is used for two body parts, *lian* 脸 'face' and *zui* 嘴 'mouth.' For *lian* the choice can be attributed to the flat surface of our face. For *zui* the choice can be understood from the verbal expression *zhang zui* 张嘴 'to open mouth.' The latter use is based on the verbal origin of *zhang* 'to stretch.'

Zhang is also used for *mianju* 面具 'mask' and *zuilian* 嘴脸 'expression.' Since both words are closely associated with the face, this extended use of *zhang* is understandable. The case of *zuilian* further involves metaphorical extension from concrete objects to abstract concepts.

3. Other Members of the Zhang Family

There are many nouns denoting objects with a flat surface, but which do not take *zhang* as their classifier, taking instead, *fu* 幅, *mian* 面, or *pian* 片. In this section, we will examine the distributional pattern of each of these three classifiers with respect to *zhang*.

3.1. The Classifier Fu 幅

Consider the following examples:

- | | | |
|---|----------------------|---|
| 6) yi fu jinduan
yi fu beimian
yi fu huabu | —幅锦缎
—幅被面
—幅画布 | 'a brocade'
'a quilt cover'
'a canvas' |
| 7) yi fu hua
yi fu huaxiang
yi fu zi | —幅画
—幅画像
—幅字 | 'a painting'
'a portrait'
'a calligraphy' |
| 8) yi fu fanrongde jingxiang
'a flourishing atmosphere'
yi fu dongrende qingjing
'an emotionally-moving scene' | —幅繁荣的景象
—幅动人的情景 | |

The classifier *fu* originated as a noun meaning 'width of cloth.' It was first used as a classifier for cotton and silk textiles and for products made from them, and it was later used for paintings and portraits. These two usages of *fu* as a classifier continue into modern Chinese, as can be seen in (6) and (7). Based on this historical development, we treat the examples in (6) as prototypes, and those in (7) as extended members from the prototypes. This extension is based on the similarity shared by members of both groups, namely, a flat surface with a picture on it. The examples in (8) involve mental pictures and can be treated as metaphorical extensions from (7). In short, the examples in (6) are prototypes, those in (7) natural extensions, and those in (8) metaphorical extensions.

For most of the objects exemplified in (7), *zhang* and *fu* are interchangeable. There is a slight difference for educated careful speakers of modern Chinese, however; for paintings and designs made of cloth or canvas, such as *cixiu* 刺绣 'embroidery' and *youhua* 油画 'oil painting,' *fu* is preferred over *zhang*.

3.2. The Classifier Mian 面

The use of the classifier *mian* can be illustrated with the following examples:

- | | | |
|------------------------------------|--------------|-------------------------------|
| 9) yi mian jinqi
yi mian jingzi | —面锦旗
—面镜子 | 'a silk banner'
'a mirror' |
|------------------------------------|--------------|-------------------------------|

yi mian tongluo	一面铜锣	'a gong'
yi mian gu	一面鼓	'a drum'
yi mian qiang	一面墙	'a wall'

Mian as a noun means 'face,' and when it is used as a classifier it refers to flat objects or objects with a flat surface. Interestingly, *mian* is not interchangeable with *zhang* despite their mutual reference to flat objects. They differ, however, in that objects classified with *zhang* merely must have a flat surface, whereas those classified with *mian* have a front side, or 'face' to it. For example, *jingqi* 锦旗 'silk banner' is printed on one side, and *jingzi* 镜子 'mirror' obviously as a front side. While *mian* is not interchangeable with *zhang*, it is interchangeable with *fu* for some objects. For instance, for 'a silk banner,' one can say either *yi mian jingqi* or *yi fu jingqi*. That *fu* can also be used here is what one would expect, since *fu* refers to flat objects that have a design or picture on them.

3.3. The Classifier *Pian* 片

The categorical structure of *pian* can be illustrated by (10) through (13):

- | | | |
|----------------------|-------|-------------------------------|
| 10) yi pian mianbao | 一片面包 | 'a slice of bread' |
| yi pian niurou | 一片牛肉 | 'a slice of beef' |
| yi pian anmian yao | 一片安眠药 | 'a sleeping pill/tablet' |
| 11) yi pian caoyuan | 一片草原 | 'a stretch of grassland' |
| yi pian shamo | 一片沙漠 | 'a stretch of desert' |
| yi pian haimian | 一片海面 | 'an expanse of ocean surface' |
| 12) yi pian yu | 一片雨 | 'a sheet of rain' |
| yi pian huohai | 一片火焰 | 'a sheet of flames' |
| 13) yi pian zhenxin | 一片真心 | 'in all sincerity' |
| yi pian huanteng | 一片欢腾 | 'a scene of great rejoicing' |
| yi pian hunluan | 一片混乱 | 'a scene of confusion' |
| yi pian jiaobu sheng | 一片脚步声 | 'a patter of footsteps' |

The noun *pian* originally had the meaning of 'a piece of wood,' and was then extended to mean 'a piece of' not only wood but other objects as well. For example, in modern Chinese *pian* can occur in such compounds as *mupian* 木片 'wood chip' and *roupian* 肉片 'sliced meat.' As a classifier, *pian* originally referred to thin, flat objects. Based on the historical development

of *pian* as a classifier (Liu 1965:119-121), we can treat objects in (10) as the prototypes, with larger surfaces in (11) as an extension to an expanse of a continuous surface. (12) is then a further extension from continuous surfaces to a multitude of objects that are physically discontinuous but visually form the appearance of a continuous flat surface. (13) is the metaphorical extension from (12) to symbolize the full extent of some emotion, atmosphere, and the sights and sounds accompanying some event.

With respect to interchangeability of *pian* with the other three classifiers - *mian*, *zhang*, and *fu* - *pian* and *mian* are not interchangeable; each take different nouns. *Pian* is also not generally interchangeable with *zhang*, at least not without changes in meaning. For example, *yi zhang zhi* 一张纸 means a whole sheet of paper, but *yi pian zhi* 一片纸 denotes a small piece of a sheet of paper. Similarly, as noted in section 2.4, while *pian* is used as a classifier for small-sized leaves, such as *chaye* 茶叶 'tea leaf,' *zhang* is used for large-sized leaves, such as *heyehou* 荷叶 'lotus leaf' and *bajiao ye* 芭蕉叶 'banana leaf.' However, for many speakers, such leaves as *fengye* 枫叶 'maple leaf' can take both *pian* and *zhang*. We can consider this overlapping as due to the fuzzy boundary between what one might consider to be small-sized leaves versus large-sized ones.

Pian is interchangeable with *fu* only in some rare instances involving metaphorical extensions. For example, both *pian* and *fu* can be used in the expression, *yi pian/fu fanrongde jingxiang* 一片/幅繁荣的景象 'a flourishing atmosphere.' However, they differ in imagery: while the phrase with *pian* emphasizes the vastness of the flourishing environment, the phrase with *fu* elicits a mental image of that flourishing atmosphere.

4. Conclusion

In this paper, we have conducted a semantic study of the classifier *zhang* and its family members, *fu*, *mian*, and *pian*. All four classifiers refer to objects that have a flat surface. Thus, their distribution with respect to the noun classes that they select sometimes overlap. However, as observed in section 3, they are typically not interchangeable without affecting meaning or imagery. They are distinguished from each other according to certain salient, cognitive features. *Zhang*, the central member, is for two-dimensional, flat objects, such as *pi* 皮 'skin' and *zhi* 纸 'paper,' or three-dimensional objects with a flat surface that interacts closely with the human body, such as *zhuozizi* 桌子 'table' and *yizi* 椅子 'chair.' Of the other three members, the overall pattern that emerges from this study is as follows. *Fu* is for two-dimensional, flat, thin

objects that have a picture, design or pattern on its surface, such *beimian* 被面 'quilt cover' and *hua* 画 'painting.' *Mian* is for two- or three-dimensional objects with a flat surface that serves as the front side or 'face' for functional purposes, such as *jingzi* 镜子 'mirror' and *gu* 鼓 'drum.' And *pian*, the last of the members, is for two-dimensional, small, thin objects that can usually be construed as parts of a whole, such as *yi pian mianbao* 一片面包 'a slice of bread,' or for two-dimensional, continuous expanse of land or water, such as *caoyuan* 草原 'grassland' and *haimian* 海面 'ocean surface.' Here, we hasten to add that even though the conventional images for these four classifiers are cognitively-based, their distribution with respect to the nouns that they select may have been influenced by historical residues.

Observe also that not all objects with a flat surface are classified by the *zhang* family. For example, *guizi* 柜子 'cupboard' does not take *zhang*; instead, it takes the general classifier, *ge*. Both *zhuozi* 'table' and *guizi* 'cupboard' are three-dimensional objects with a flat surface. One crucial difference between them is that, while the surface of the table is specifically designed for human activities, that of the cupboard is not. It shows that human categorization, shape in this case, does not necessarily depend on intrinsic, physical characteristics of objects; rather, it depends on how humans interact with these physical objects.

The above explanation, however, cannot account for such flat-faced objects as *heiban* 黑板 'blackboard' and *shibe* 石碑 'rock inscription,' which take the classifier *kuai*, a classifier typically used for three-dimensional objects. One possible explanation for these objects taking *kuai* is that they are (or were originally) made of stone, and *shitou* 石头 'stone' takes the classifier *kuai*. Other objects with a flat surface, such as *jiangtai* 讲台 'platform,' *tiatai* 跳台 'diving platform,' and *wutai* 舞台 'stage,' take the general classifier *ge* rather than the *zhang* family. We do not have an explanation, and can only offer the observation that all these cases involve contact with the feet only. There are still other flat objects which take specific classifiers because of historical usage. For example, *pi* 匹 for *bu* 布 'cloth' and *ben* 本 for *shu* 书 'book.' These specific classifiers override *zhang*, which serves as a default classifier for flat objects.

Furthermore, as pointed out by Tai (1992), a classifier often exhibits different membership in different dialects. The classifier *zhang* is no exception. In Southern Min, *zhang* is used primarily for flat objects made of paper (Wu 1994). For tables, *kuai* is used instead. Perhaps tables are perceived as three dimensional rather than two-dimensional objects. For beds, the classifier *ding* 顶 'top' is used. It may have to do with the fact that

traditional beds have tops. It remains to be seen to what extent dialectal variation in classifiers can be accounted for by the cognition-based framework proposed in Tai (1992).

Partly because of the opacity caused by historical residues and partly because of interference from dialectal variation, classifiers in Chinese may appear to be too recalcitrant for a cognition-based semantic analysis. However, based on the findings from Tai and Wang (1990) on the *tiao* family and this study on the *zhang* family, we have every reason to pursue further this line of research on Chinese classifiers.

A final remark is in order. We have constructed a prototype theory of categorization of *zhang* and other members of its family by making use of its historical development. One is justified to question whether the prototype theory thus constructed has any psychological effect. It is quite possible that the prototypes of *zhang* identified through various psychological experiments may fall on members of the second extension of *zhang*, or on members of the third extension. It is our hope that this study would be of interest and use for psycholinguistic research on this classifier. It is also our hope that our study would be of use in teaching the classifiers *zhang*, *fu*, *mian*, and *pian* to speakers of other languages.

NOTES

*We have benefited from discussion with Marjorie Chan, Roxana Fung, Wenze Hu, and Sue-mei Wu. Needless to say, we are solely responsible for possible errors herein.

1. A Chinese zither, *guzhen*, has several strings stretched across the instrument forming a flat, though not solid, surface. This is not so unlike nets, which also do not form a solid, flat surface but has, instead, criss-crossing of ropes to form a flattish surface. We can view zithers as constituting a borderline member between the group of prototypes and the group of the first extension.

2. Y.R. Chao (1968:591) treats the use of classifier *ba* as standard for *yizi* 椅子, and that of the classifier *zhang* as dialectal.

REFERENCES

- Adams, K. and N. Conklin. 1973. 'Towards A Theory of Natural Classification.' *Papers from the Ninth Regional Meeting, Chicago Linguistic Society*, 1-33.
- Allan, Keith. 1997. 'Classifiers.' *Language* 53.2:285-311.
- Chao, Yuen Ren. 1968. *A Grammar of Spoken Chinese*. Berkeley: University of California Press.
- Craig, Colette, ed. 1986. *Noun Classes and Categorization*. Amsterdam, Philadelphia: John Benjamins Publishing Company.
- Denny, J. Peter. 1976. 'What are Noun Classifiers Good For?' *Papers from the Twelfth Regional Meeting, Chicago Linguistic Society*, 122-132. Chicago Linguistic Society.
- Erbaugh, Mary. 1986. 'Taking Stock: The Development of Chinese Noun Classifiers Historically and In Young Children.' In Craig, ed. (1986), 399-436.
- Lee, Michael. 1988. 'Language, Perception and the World.' In John A. Hawkins, ed. *Explaining Language Universals*, 211-246. Oxford: Blackwell Ltd.
- Liu, Shiru. 1965. *Weijin Nanbei Chao Liangci Yanjiu (A Study of the Classifiers of the Weijin Nanbei Dynasties)*. Beijing: Zhonghua Chubanshe.
- Tai, James H-Y and Liangqing Wang. 1990. 'A Semantic Study of the Classifier Tiao.' *Journal of the Chinese Language Teachers Association* 25.1:35-56.
- Tai, James H-Y. 1992. 'Variation in Classifier Systems Across Chinese Dialects: Towards a Cognition-based Semantic Approach.' In *Chinese Language and Linguistics. Volume 1: Chinese Dialects. Symposium Series of the Institute of History and Philology, Number 2*, 587-608. Academia Sinica, Taiwan.
- Tai, James H-Y. 1994. 'Chinese Classifier Systems and Human Categorization.' In Matthew Chen and Ovid Tzeng, eds. *Essays in Honor of Professor William S-Y. Wang*, 479-494. Taipei: Pyramid Publishing Company.
- Wu, Sue-mei. 1994. 'A Prototype Theory of the Classifier Zhang in the Southern Min Dialect.' Manuscript, The Ohio State University.