# Traces of Embodiment in Chinese Character Formation

## A Frame Approach to the Interaction of Writing, Speaking, and Meaning

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### Abstract

In this paper, we develop a frame approach for modelling and investigating certain patterns of concept evolution in the history of Chinese as they are reflected in the Chinese writing system. Our method uses known processes of character formation to infer different states of concept evolution. By decomposing these states into frames, we show how the complex interaction between speaking, writing, and meaning throughout the history of the Chinese language can be made transparent.

## 1   Introduction

In this paper, we discuss the complex interaction of the written form, spoken form and meaning in Chinese. We show that conceptual processes such as metonymy or metaphor and the sensory-motor grounding of human conceptualization are reflected in Chinese character development. Our analysis is based on the modelling of conceptual processes by means of a frame-based approach to character formation.

After introducing the notion of *embodiment* and its role for language development and linguistic analysis, we point out some general properties of the Chinese writing system, i. e. Chinese character forms, their place in traditional sign models and principles of character formation. We then give a short introduction on how concepts can be modelled as recursive attribute-value structures called *frames*. The main section consists of a frame-based analysis of selected character formation processes which illustrate the different ways phonemic, graphemic, and semantic components interact.

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## 2    Embodiment and language

The term *embodiment* refers to a number of partly overlapping theories whose common denominator is the claim that cognition requires the interaction of a body with the world (Wilson 2002, Ziemke 2003). The view we adopt in this paper is that abstract concepts evolve on the basis of concepts which arise from perception and action. This approach is taken by Barsalou (1999) who proposes that concepts are constructed from *perceptual symbols*, i. e. subsets of modal representations which are stored in long-term memory and reused symbolically to stand for objects in the world.

### 2.1    Conceptual development and language reconstruction

Lakoff and Johnson (1980) were the first of now many linguists (e. g. Gibbs 2003 and Steen 2010) to underline the fundamental role that metaphor plays in the construction of abstract concepts based on physical concepts. They postulate that systematic correlates between emotions (such as happiness) and more basic sensory-motor experiences (such as an erect body posture, which is supposed to be often concomitant with happiness) lead to the metaphorical understanding of the more abstract concept on the basis of the concept resulting from the perceptual experience (Lakoff 1980: 58). This conceptual relation is reflected in language where words like *up* and *down* stand for spatial concepts as well as for emotional states: *cheer up!, I'm feeling a bit down, we've had our ups and downs.*

Thus, the word *up* preserves information regarding the sensory-motor source concept which underlies the abstract emotional concept. The link, which allows the inference that there is a relation between the two concepts, is the fact that they are associated with the same sound chain [ʌp]. Moreover, the emotional concept became a meaning of *up* only recently, whereas the spatial meaning is close to that of the Indo-European etymon *\*upo* ‹under, from under› (Pokorny 1959).

Not all cases are phonetically and morphologically as transparent as *\*up*, which means that more reconstruction work concerning the *formal part of the linguistic sign is necessary to be able to draw *conclusions about the semantic side. The sound chain of the Latin word *\*capacitas* ‹ability› goes back to the Indo-European root *\*keh$_2$p-* ‹to seize, to grasp› via Latin * *capere* ‹to seize› – or to the non-laryngealized * *\*kap-*, which cannot be excluded – (Georges 1998, Rix et al. * [2]2011), and French [ʃɛf] ‹boss, * chief› stems back from Latin [kaput] ‹head› (Gamillscheg 1997, see Figure * 1 and Figure 2), which in turn might be derived from the root of Latin * *capere* as well (Vaan 2008).
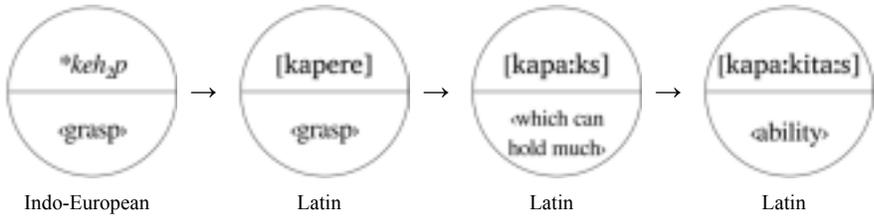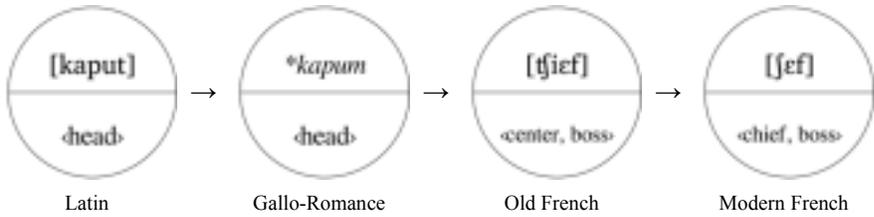
Fig. 1: Etymology of Latin *capacitas*.



Fig. 2: Etymology of French *chef*

Independently of the morphological * transparency, the genetic relation (or identity as in the case of * *up*) between the sound chains can thus be seen as a trace of the * sensory-motor grounding of the more abstract concepts ‹ability› and ‹boss› * on the basic concepts ‹grasp› and ‹head›. This information about * conceptual development is of interest for historical semanticists and * cognitive scientists in search of linguistic evidence for embodiment.

However, reconstructing the history of a word, i.e. regressing its sound chain back to earlier forms, leads to a sound chain which is no less arbitrary with respect to the concept it designates than the word itself. Tracing back the evolution of French *chef*, we obtain the Latin word *caput*. Its sound chain does not tell us anything about its meaning which is something we have to investigate at the same time.[1]

## 2.2 Traces of embodiment in Chinese character forms

As we have seen, reconstructing the form of a linguistic sign does not automatically provide knowledge about its meaning. This is different with the Chinese writing system.

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[1] Our anonymous reviewer points out that the *-ut* ending does contain information about gender, declension or number, and thus provides semantic content. However, this does not alter our argument because *-ut*, as a linguistic sign, is as arbitrarily linked to its meaning as *cap-*.

Chinese characters consist of 1) the character meaning, 2) the character reading, i. e. a sound chain, and 3) the (written) character form. Reconstructing the evolution of the character form does not lead us to a collection of brush strokes related arbitrarily to any kind of concept, but to an iconic image character, to a representation of the concept originally designated by the form.



Fig. 3: Development of the Chinese character forms for ‹chief, first› and ‹fish›.

Consider the Chinese character forms for the concepts ‹chief, first› and ‹fish› (*shǒu* 首 and *yú* 魚, see Figure 3). Tracing back their evolution, we obtain less abstract images and end up with the source concept of ‹chief› which is ‹head› and for ‹fish› which is, not surprisingly, ‹fish›. The abstract concept ‹chief, first› is grounded on the physical, bodily concept ‹head› whereas ‹fish› is not grounded on another basic concept as it is, in itself, a concept with physical, visible and touchable instantiations which are directly perceivable by sensory-motor means.

Thus, the successful reconstruction of the Chinese character form directly provides the concept associated with it. Of course, we do not deny that even the interpretation of the underlying image is subject to a certain arbitrariness. In the case of Chinese *shǒu* 首, for example, it cannot be completely ruled out that the underlying image depicts something else than a head; and even if we admit that it shows a head the question arises as to what kind of head it is. However, because of their form representing character, these signs are less open to interpretation than are non-onomatopoeic sound-based signs: assuming that we do not have any additional information, an icon provides more

clues than a sound chain. This makes the Chinese writing system attractive for the study of embodiment.

## 3 Chinese characters

The Chinese writing system (CWS), as we know it today, is famous for its structural properties reflected by a complicated interaction of phonetic and semantic elements.[2] Since the Chinese characters can be divided into elements carrying phonetic as well as semantic functions, it is sometimes called a 'semanto-phonetic writing system' (*yìyīn wénzì* 意音文字, cf. in Zhōu 1998: 60), yet this characterization exaggerates the actual power of Chinese characters to display phonetic information in a transparent way: Most of the "phonetic" characteristics of the CWS are relics of the processes of character formation which, as they took place asynchronously, were always characterized by a complex interaction between the Chinese language spoken at different times of its history, the sociocultural background of those people who created the characters, and general patterns of reasoning and conceptualization.

### 3.1 General characteristics of the Chinese writing system

From a phonetic perspective, the CWS can be characterized as a *syllabic writing system*, since every character represents a syllable of the Chinese language. From a semantic perspective, on the other hand, it is a *morphemic writing system*, since the majority of all characters represents a minimal semantically meaningful unit of the Chinese language. In contrast to the dichotomic structure of alphabet systems, a Chinese character therefore has a trichotomic structure, since it can be characterized by its *form*, its *meaning*, and its *reading* (List 2009). Thus, the Chinese character *cǎi* 采 ‹to pluck› is defined by its written form 采, its meaning 'to pluck', and its reading [tsʰai²¹⁴] (see Figure 4). Given this specific structure, we prefer the term *morpheme-syllabic writing system* (Chao 1968: 102) over the above-mentioned term *semanto-phonetic writing system*, since this term more closely reflects the concrete units of the semantic and the phonetic domain that are referred to by a Chinese character.

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2   The use of the term "phonetic" follows the terminology that is used in the mainstream discussions on the topic. Our anonymous reviewer, however, is surely right in stating that it is rather "morphonological" than strict "phonetic identification" we are dealing with here.

Fig. 4: The trichotomic structure of Chinese characters.

## 3.2 External and internal structure of Chinese characters

An important aspect of Chinese character forms is their two-fold structure: Character forms can be analysed with respect to their *external* and their *internal structure* (List 2008: 45 f.). Here, *external structure* refers to the formal aspects of the way the forms are built, i. e. the number, the order, and the direction of strokes. *Internal structure* refers to the motivation underlying the creation of the forms. While an analysis with respect to the external structure is strictly synchronic, an analysis of the internal structure is always done with respect to the diachronic dimension of a character.

As an example, consider again the character *cǎi* 采 ‹to pluck› (see Figure 5, middle). Based on its external structure one can divide the form into a sequence of eight different strokes (see Figure 5, left). The internal structure, on the other hand, can only be understood when going back in time and looking at the oracle bone version of the form, which dates back to around 1000 BC (see Figure 5, right). Here, one can see a hand which plucks some kind of fruit from a plant.[3] Judging from the old version of the character form alone, the pictographic motivation might not be too obvious. But both the picture for ‹hand› and the picture for ‹fruits on a plant› are reflected in other old character forms as well, so there can be little doubt that the original motivation for the creation of the character form was to depict the process of grasping.

## 3.3 Basic types of Chinese character formation

By now, it should have become clear that – in contrast to many alphabetic systems – the formation of the Chinese character forms was not accomplished ad hoc, but instead took a certain amount of time, whereby many character forms were created during

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[3] This is, of course, an overstatement, since we cannot see an action on a static picture, but have to infer the action from what we see.

Fig. 5: Chinese character form (middle) with its internal (right) and its external (left) structure.

different time periods. The way new character forms were derived remained, however, rather stable during the history of the CWS.

Based on the internal structure of the form, one can roughly distinguish three different types of character forms: (1) *semantic characters*, i. e. characters whose formation was only semantically motivated, (2) *phonetic characters*, i. e. characters whose formation was purely phonetically motivated, and (3) *semanto-phonetic characters*, i. e. character forms whose formation was both semantically and phonetically motivated.[4] As an example for the first formation type, consider, again, the character *cǎi* 采 ‹to pluck›. As was shown in the preceding paragraph, its form was originally a pictogram of a hand grasping some kind of fruit. Therefore, the motivation was purely semantic. The original form never provided any hint regarding the pronunciation of the word which it was supposed to refer to.[5] As an example for the second formation type, consider the character *kù* 酷 ‹cool›. This is a recent borrowing from English, pronounced as [ku$^{51}$] in Chinese, and the Chinese reflection of the word *cool* in the modern sense of *being Cowboy-like* and *calm.* Since the Chinese originally did not have a written representation for this loan word, they chose to use another character with an identical reading in order to reflect this specific word, resulting in a pure phonetic motivation for this specific use of the character.[6] As an example for the third formation type, which combines phonetic and semantic motivation, consider the same character *kù* 酷 with its original meaning ‹cruel›. Its form can be divided into the two elements *yǒu* 酉 ‹bottle with liquid› and *gào* 告 ‹to tell›, where the first probably serves as a semantic trigger for the original meaning of the word ("ripe"), while the second has a phonetic function,

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[4]  This is a very rough classification of Chinese characters, for a more refined classification, see, e. g., List (2008).

[5]  At least we don't have positive evidence for a phonetic function.

[6]  This is a bit of an oversimplification, since in China the selection of characters to represent words that have so far no written representation is always driven by certain semantic considerations.

giving a hint to the pronunciation of the word (cf. Old Chinese *k$^ˤ$uk for 告 vs. *k$^{hˤ}$uk for 酷).[7]

Based on this rough distinction between the three different types of character forms, one type of *primary* and two types of *secondary character formation* can be distinguished. *Primary character formation* was often pictographic or ideographic. *Secondary character formation*, i. e. the formation of character forms based on already existing ones, was either based on *phonetic borrowing* or on *semantic reinforcement*.[8] As an example, consider the character *xiàng* 象 ‹elephant›. The formation type of its character form is primary, since it originally was semantically motivated, as a pictogram of an elephant, and one can therefore display the relations between meaning, reading and form of the character as illustrated in Figure 6 (left). Yet, already very early on, the Chinese used this character form not only for ‹elephant›, but also for ‹image›, which was pronounced in the same way as the word for elephant. Lacking a character form for such an abstract concept, they simply took the Chinese character form for ‹elephant›, and assigned it a different meaning. Therefore, the second meaning of the form 象 is purely phonetically motivated, and a new character was formed by means of borrowing. The relation between reading, form, and meaning can be displayed as illustrated in Figure 6 (middle). In even later times, the Chinese apparently did not feel quite comfortable with having two meanings expressed by a single character form, and so they created a new character for ‹image›. This was done by adding a semantic element to the character form, which would distinguish ‹elephant› from ‹image›. Taking the form of the character *rén* ‹human› as an additional semantic element, a new character was built by means of semantic reinforcement. In contrast to the previous character forms, the new form has a double reference to both the reading and the meaning of the character, as illustrated in Figure 6 (right).

## 4   Frames

In cognitive sciences, the term *frame* is used for several kinds of meaning representations of situations or objects. What all approaches have in common is that concepts are not considered as atomic units, but rather as highly structured entities. Barsalou (1992) develops his frame theory in contrast to meaning representations by feature lists, as

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[7]  Old Chinese readings follow Baxter & Sagart (2011).

[8]  This is a very rough description of the basic types of Chinese character formation. For a more detailed account on Chinese character formation, see especially Qiú (1989).

Fig. 6: Basic types of character formation.

they have been used in early cognitive semantics. Barsalou passes criticism on decomposing concepts in unordered samples of features because "people do not store representational components independently of one another" (Barsalou 1992: 27). Instead, Barsalou points to evidence from several experiments that human cognition is based on attribute-value structures: The attributes describe general properties or dimensions of the object or category being represented, and the values are specifications of the attributes. From this point of view, the values correspond to features in feature lists, while the attributes represent the relations between these features and the represented object or situation. According to Barsalou, frames are recursive in that values and attributes are represented in further frames. Thus, it is almost impossible to reconstruct a "complete" frame. Rather, we will always refer to partial frames in the following, i.e. we will only point out those attributes that are currently relevant.

Petersen (2007) uses directed graphs to model frames in the sense of Barsalou. In frame graphs, the arcs correspond to attributes and the nodes correspond to values (see Figure 7 for an example). The central node of the frame is marked by a double border. It designates the object or category being represented in the frame. Mathematically, attributes correspond to partial functions mapping values to values. As a consequence, attributes are right-unique, i.e. every attribute is specified by exactly one value. Because of their right-uniqueness, attributes are predestined to be named with functional nouns in the sense of Löbner (2011) who distinguishes four basic types of nouns, depending on two binary features: relationality and uniqueness. Functional nouns are inherently unique and inherently relational, because their reference to a possessum is uniquely given once a possessor argument is saturated. Typical examples are nouns like *mother* or *nose* that identify their referent uniquely according to a possessor: a mother is always a mother of someone, and everyone has exactly one [biological] mother. Anal-

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ogous statements are the case for the noun *nose.* Due to their inherent relationality functional nouns mostly occur in possessive constructions (cf. Löbner 2011: 14–18).
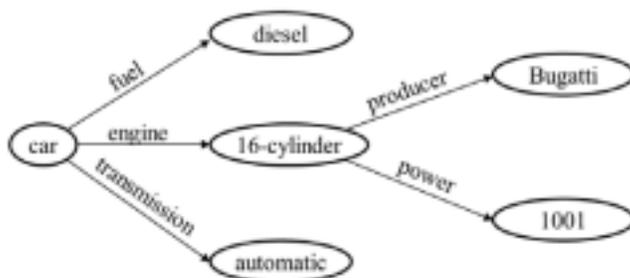


Fig. 7: *car* frame as a directed graph.

Löbner (2005) argues that functional nouns are verbalizations of attributes in frames such that concepts can be decomposed in terms of functional nouns. On this basis, we are able to identify the range of values an attribute can take. Building on Guarino (1992), we distinguish between the relational and the denotational interpretation of functional nouns. The relational interpretation refers to the relation that links the possessor somehow to the possessum. The denotational interpretation, however, is the referent to a certain possessum according to a given possessor. In mathematical terms, relational nouns are functions, where the relational interpretation corresponds to the mapping rule of the function and the denotational interpretation to the value the function takes according to a given argument. For instance, the relational interpretation of the concept *mother* in the NP *Paul's mother* is the mapping rule "*x is mother of y*", while the denotational interpretation is the referent of the NP.

Due to their twofold interpretation, functional nouns are able to designate attributes as well as their values: attributes correspond to the relational interpretation of functional nouns and values to their denotational interpretation. For instance, the functional noun *motor* describes the attribute ‹motor› in Figure 4 as "*value x is the motor of the object y*" while its denotational interpretation makes it possible to refer to the motor of the object itself. Thus, the values of an attribute have to be hyponyms of the denotational interpretation of the functional noun with which the attribute is named. This interpretation of attributes is in line with Barsalou who postulates that "[v]alues are subordinate concepts of an attribute" (Barsalou 1992: 31). A special case is attributes in verb frames that contain information about theta roles. Their range is determined by

selectional restrictions of the verb. We will mark value ranges in verb frames by naming the range on top of the value node (see Figure 8 for an example).
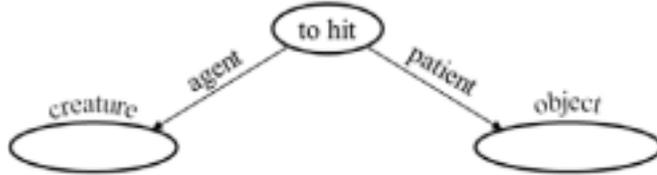
Fig. 8: Frame of the verb to *hit*.

## 5 A frame model of character formation and concept evolution

Since we assume that frames are the general format of human cognition, frame theory offers a tool to describe stages in concept evolution that are reflected in Chinese character formation. In the following, we discuss three examples which illustrate how the sensory-motor grounding of human conceptualization is reflected in the formation of new Chinese characters.

The first example illustrates the development of the character *cài* 菜 ‹vegetable›. Originally, there was no specific character for this concept, and therefore the character *cǎi* 采 ‹to pluck› was used to designate the concept. The problematic polysemy was only later resolved, and the character form was modified by adding the form of the character *cǎo* ‹grass› on top. The frame of the ‹plucking action› contains a theme argument which takes a kind of plant as its value. On the linguistic surface, ‹to pluck› could be expressed by the word [*m-sˤrəʔ], which is the way the word was pronounced around 600 BC (Baxter & Sagart 2011). Since a vegetable is something that is typically plucked when it is ripe, it is a possible value for the theme argument. Chinese word formation around 600 BC allowed the derivation of verbs by prefixation and suffixation (Sagart 1999). One common process involved the suffix [*-s] which provokes a nominalization of verbs (Sagart & Baxter 2011): adding [*-s] to [*m-sˤrəʔ] yields the word [*m-sˤrəʔ-s] which has the meaning ‹plucked (things)›.

Over time, the meaning ‹plucked (things)› developed into the more specific meaning ‹vegetable›. The metonymical relationship between ‹to pluck› and ‹vegetable› and the formal relationship between the character reading associated with ‹to pluck› and the one associated with ‹vegetable› resulted in the use of the same form for ‹to pluck›

Fig. 9: Frames for ‹to pluck a vegetable› and ‹grass›.
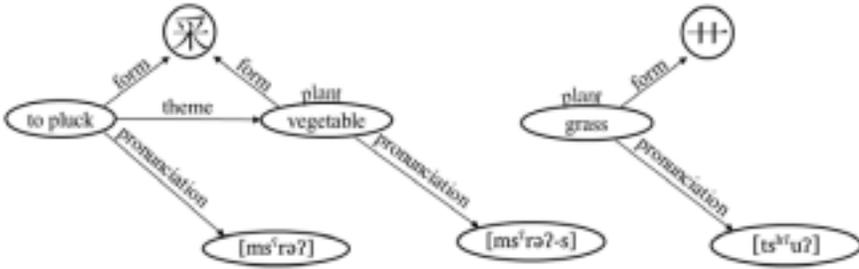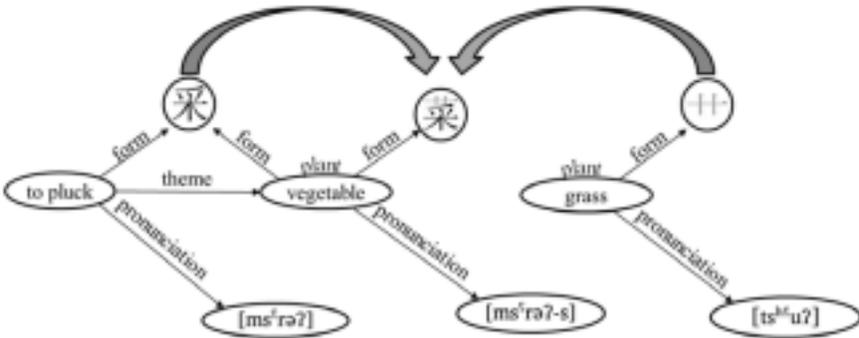


Fig. 10: Creation of a new character for the concept ‹vegetable›.

and ‹vegetable› (see Figure 9). Problematic polysemies, e. g. polysemies concerning concepts which are part of the same frame, tend to be resolved by the speakers (Blank 1997: 357). To distinguish the concepts on the linguistic surface, a new form for the concept ‹vegetable› was created (see Figure 10). The concepts ‹vegetable› and ‹grass› are instantiations of the class ‹plant›. To solve the polysemy, the form for ‹grass› is added to the form for ‹pluck›. Thus, a character form for ‹vegetable› is created by grounding the concept on the metonymically related motor action ‹to pluck› and subsequently, the ambiguity of the character form for ‹pluck› is resolved.

The second example illustrates the development of the form of the character *qǔ* 娶 ‹to marry (a woman)› which is built as a combination of *qǔ* 取 ‹to grasp› and *nǚ* 女 ‹woman› (see Figure 11). The systematic correlates between the symbolic, i.e. abstract, act of marriage and the sensory motor experiences accompanying it, i. e. taking the bride to another place, as opposed to *jià* 嫁 ‹(leaving the family) to marry (a man)›, result in the grounding of the symbolic act on the bodily actions. This is reflected in

the combination of the characters for *qǔ* 取 ‹to grasp› and *nǚ* 女 ‹woman› to a new character which stands for ‹to marry›.

The frame of a typical grasping action contains the theme argument which typically has objects as values. The form of its character *qǔ* 取 is an abstraction of a picture showing a hand grasping an ear. The pronunciation sounded approximately like [*tsʰoʔ] (Baxter and Sagart 1999).[9] The theme argument allows many kinds of values, for instance women. The concept ‹woman› is represented by *nǚ* 女, a form which originally depicted a person sitting with the legs to the side. When the class of the theme argument is ‹woman›, the whole frame represents the bodily action ‹to grasp a woman›. The concept ‹to grasp a woman› is more specific than the non-saturated concept ‹to grasp›, i. e. the upper-type concept of the theme attribute is substituted by a subsumed concept of the original concept, so that the range of the attribute is reduced (see Figure 12).

The lexicalization of this new, specialized meaning resulted in a situation where the reading [*tsʰoʔ] and the associated form 取 had two taxonomically related meanings. This problematic polysemy was resolved by merging the characters *qǔ* 取 ‹to grasp› and *nǚ* 女 ‹woman› to create the new form *qǔ* 娶 which stands for the concept ‹to marry (a woman)›, an abstract concept grounded on the sensory motor concept ‹to grasp a woman› (see Figure 13).

The third example illustrates the creation of the character *xiǎng* 想 ‹to think› which – judging from its derivation as a compound of the characters *xiāng* 相 ‹to observe› and *xīn* 心 ‹heart/mind› – can be metaphorically understood as ‹to observe with one's heart/mind›. This means again that an abstract concept is put down to a sensory motor concept which results directly from perceptual experience. The metaphorical process consists of a modification of the attribute-value structure of the concept ‹to observe› – which typically takes as instrument the concept ‹eye› (see Figure 14) – as the instrumental argument is saturated by the concept ‹heart›. As the argument saturation violates the original concept structure, no literal understanding is possible, so that the resulting concept is necessarily abstract.

In the abstract concept, ‹heart/mind› figures as the value of the instrumental argument. The reading that represented the concept ‹observe with one's heart/mind›, i. e. ‹to think›, was derived from the pronunciation of the more general concept ‹to observe›: [*saŋs] was changed to [*saŋs-ʔ > *saŋ-ʔ], meaning ‹to think› (Schuessler

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[9]  As the anonymous reviewer pointed out, this is the practice of "cutting off the ears of an enemy and hanging them on a ritual girdle as a trophy, later called *guó* 聝."
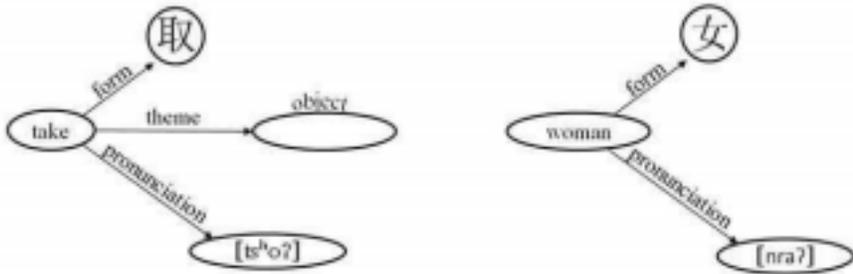
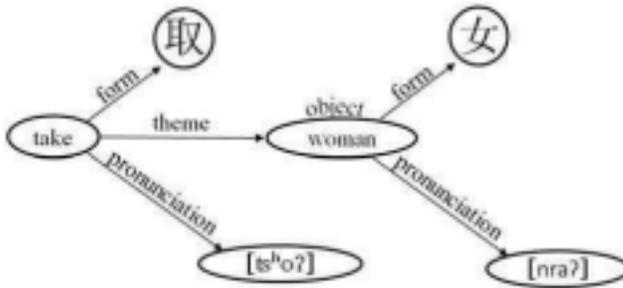Fig. 11: Frames of ‹to grasp› and ‹woman›.



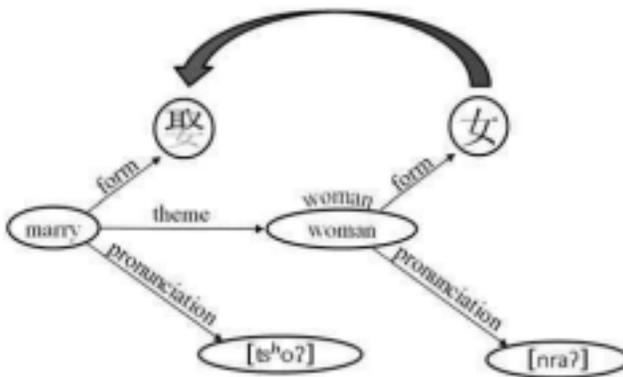Fig. 12: Frame of the more specific concept ‹to grasp a woman›.



Fig. 13: Creation of a new character for ‹to marry (a woman)›.

2007: 46 f.). The polysemy of the form which now stood for ‹to observe› and ‹to think› was disambiguated by integrating the character form for *xīn* 心 ‹heart/mind› into the character form for *xiāng* 相 ‹to observe› (see Figure 15).
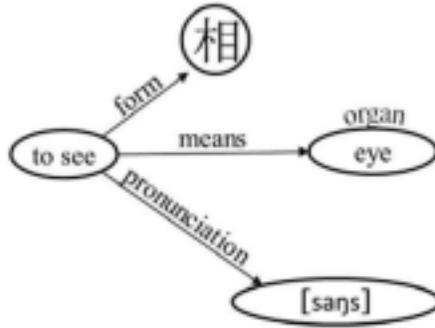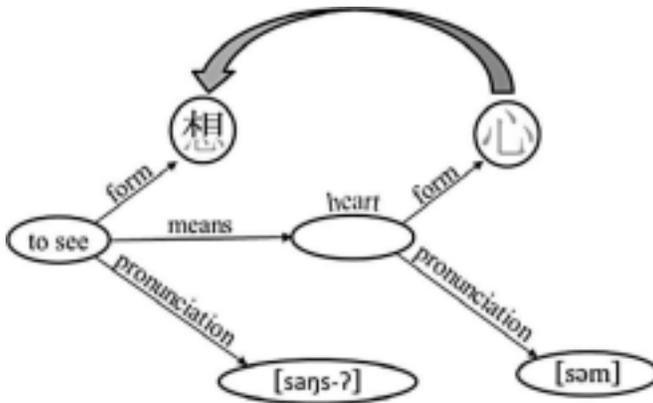


Fig. 14: Frame of ‹to see›.



Fig. 15: Creation of a character for ‹to think›.

## 6   Summary

The processes of Chinese character formation reflect different states in concept development. They are well documented throughout the history of Chinese. Thus, the Chinese language offers rich possibilities to study concept evolution. Frame theory offers a tool for decomposing these different states in concept evolution in a cognitively adequate

way. Therefore, a frame approach may shed new light on concept development by analysing the interaction between writing, speaking, and meaning. In this paper, we demonstrated how frames can be used to model and investigate such different instances of concept evolution as metonymy, argument saturation, and metaphora. At the current state, our work remains exploratory, yet we are confident that the method provides a promising starting point for future research.

# 7 Acknowledgements

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