科技部補助專題研究計畫成果報告

（□期中進度報告/■期末報告）

（隱喻概念與手勢）

計畫類別：■個別型計畫　□整合型計畫
計畫編號：MOST 100 - 2628 - H - 004 - 136 - MY3
執行期間：100 年 8 月 1 日至 103 年 7 月 31 日
執行機構及系所：國立政治大學英國語文學系

計畫主持人：徐嘉慧
共同主持人：
計畫參與人員：

本計畫除繳交成果報告外，另含下列出國報告，共 2 份：
□執行國際合作與移地研究心得報告
■出席國際學術會議心得報告

期末報告處理方式：

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2. 「本研究」是否已有嚴重損及公共利益之發現：■否 □是
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中　華　民　國 103 年 10 月 21 日

科技部補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現（簡要敘述成果是否有嚴重損及公共利益之發現）或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■ 達成目標

□ 未達成目標（請說明，以 100 字為限）

□ 實驗失敗

□ 因故實驗中斷

□ 其他原因

說明：

- New data were collected and transcribed, while old data were checked, revised and confirmed by different analysts.
- A sizable amount of metaphoric gestures was identified and analyzed with respect to categorization of linguistic metaphors, categorization of metaphoric gestures, cross-domain mapping, embodiment, dynamism, linguistic-gestural synchronization and information state.
- Two psycholinguistic experiments were conducted to investigate the speech-gesture integration during language comprehension, and the effect of different types of gestures on metaphor comprehension.
- Research findings were presented in international journals and published in international journals.

2. 研究成果在學術期刊發表或申請專利等情形：

論文：■已發表 □未發表之文稿 □撰寫中 □無

專利：□已獲得 □申請中 ■無

技轉：□已技轉 □洽談中 ■無

其他：（以 100 字為限）

Chui, Kawai. 2014. Mimicked gestures and the joint construction of meaning in conversation. *Journal of Pragmatics* 70: 68-85. (SSCI, AHCI)

Chui, Kawai. 2013. Gesture and embodiment in Chinese discourse. *Journal of Chinese Linguistics* 41(1): 52-64. (SSCI, AHCI)

Chui, Kawai. 2012. Gestural manifestation of knowledge in conceptual frames. *Discourse Processes* 49(8): 599-621. (SSCI)

Chui, Kawai. 2012. Cross-linguistic comparison of representations of motion in language and gesture. *Gesture* 12(1): 40-61. (SSCI, AHCI)

Chui, Kawai. 2011. Do gestures compensate for the omission of motion expression in speech? *Chinese Language and Discourse* 2(2): 153-167. (MLA, LLBA, LB)

Chui, Kawai. 2011. Conceptual metaphors in gesture. *Cognitive Linguistics* 22(3): 437-458. (SSCI, AHCI)

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性），如已有嚴重損及公共利益之發現，請簡述可能損及之相關程度（以 500 字為限）

New spoken data were added to The Corpus of Spoken Mandarin, a sub-corpus of The NCCU Corpus of Spoken Chinese; old data were checked and confirmed by different analysts. Numerous scholars and graduate students in Taiwan and in foreign countries are using the spoken Mandarin raw data for teaching and research purposes.

Based upon the quantitative-qualitative analysis of a sizable amount of linguistic-gestural metaphors in narrative and conversational data, the study in this project found that ENTITY metaphors and ORIENTATION metaphors most frequently occur in daily conversation. The most common source-domain concept for ENTITY metaphors is OBJECT; those for ORIENTATION metaphors are SPACE and PATH. The study provided empirical data for one-source-to-many- targets and many-sources-to-one-target correspondences. The linguistic-gestural representation of metaphors and the synchronization of speech and gesture bear out the Interface Hypothesis that "a gesture is shaped by the formulation possibilities of the language…and at the same time the gesture may encode the spatio-motoric information that is not expressed in the speech" (Kita and Özyürek 2002: 18). Another focus of research was to conduct experiments to investigate how people comprehend metaphorical ideas as expressed in language and gesture. Two psycholinguistic experiments were conducted and the findings help understand the speech-gesture integration during language comprehension, and the effect of different types of gestures on metaphor comprehension. The findings have also been presented in international conferences and published in international journals.

The graduate students who participated in the project were trained to transcribe spoken data and gestures, so that they could better understand spoken grammar and the use of gesture in speech communication. Three of them worked on language and gesture with spoken data for their master theses.

Finally, the study promoted cross-disciplinary cooperation between linguistics and neuroscience. The equipment and the experimental techniques that the two psycholinguistic experiments needed were provided by the Research Center for Mind, Brain and Learning at National Chengchi University. With the behavioral results, it is hoped that there will be cross-disciplinary neurolinguistic studies of language-gesture comprehension in near future.

出席國際學術會議成果報告

計畫編號	NSC 100-2628-H-004 -136 -MY3
計畫名稱	隱喻概念與手勢
出國人員姓名 服務機關及職稱	國立政治大學英語系徐嘉慧教授
會議時間地點	2012/8/1 - 2012/8/4 Sapporo, Japan
會議名稱	The 34th Annual Cognitive Science Conference
發表論文題目	Comprehension of representational gestures

一、參加會議經過

The 34th Annual Cognitive Science Conference (CogSci 2012) 是每年舉辦的認知科學會議，涵蓋的領域有 Linguistics, Artificial Intelligence, Anthropology, Psychology, Neuroscience, Philosophy, 及 Education。這次會議包括論文的發表、專題演講及專題研討論。本人的論文 Comprehension of representational gestures 於 8 月 4 日下午發表。

二、與會心得

參加 CogSci 2012 讓本人獲益良多，可以瞭解認知心裡學如何討論語言的議題。本次會議有不少跟語言學有關的論文，包括Language Acquisition、Pragmatics and Language Use、Language and Conceptual Structure、Sentence Processing、Word Learning、Language Production、Categorization、Language and Semantic Representation、Language Understanding、Language and Speech、Semantic Networks and Concepts、Spatial Cognition。本人近三年研究「隱喻概念與手勢」，而本次會議有兩個 sessions 跟手勢的研究有，分別是 embodied cognition 和 language and gesture；也有幾篇手語的論文，可見手勢和手語的研究跟語言學、認知心理學有密切關係。目前投入自然手勢的研究仍非常少，需要大家更多的努力。

Comprehension of Representational Gestures

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Introduction

Representational gestures are the spontaneous manual production in verbal communication with the following features: obligatory presence of speech, linguistic properties absent, not conventionalized, global and synthetic (McNeill 2000). They convey meaning related to the semantic content of the speech.

Topic: Making-friend activity in college
Speech: Someone will throw an embroidered ball to the crowd
Gesture: Throwing downward

In contrast, self-adaptors, which are self-touching movements, such as scratching on the arm, do not convey substantial meaning.

In daily communication, the spontaneous use of hands and arms along with speech is pervasive and indispensable when people engage in conversational talk.

When the speaker conveys a message, speech and representational gestures often work in collaboration to express similar or different information.

The integrated relationship between speech and gesture has been supported by "studies from the field of cognitive neuroscience [which] complement the work from psychology – gesture influences the behavioral processing of speech during language production and comprehension, and one explanation for this behavioral finding is that gesture and speech are integrated in space and time in the brain's processing of this information" (Kelly et al. 2008: 6-7; also Kelly et al. 2004, 2010; Wu and Coulson 2007).

Nevertheless, speech-gesture integration was also found to be affected by the amount of observed meaningful hand movements (Holle and Gunter 2007), people's knowledge about intentionality (Kelly et al. 2007), and the strength of the semantic incongruence between the two modalities (Kelly et al. 2010).

Thus, whether the integration is obligatory and automatic in comprehension is still an open question.

The present study conducted an experiment to address the issue of speech-gesture integration by examining (1) how representational gestures and self-adaptors are comprehended in communicative

situations, and (2) whether representational gestures and self-adaptors are comprehensible when the accompanying speech is not clear.

Method

Participants

Twenty university undergraduates, aged from eighteen to twenty-two, participated in the experiment. They were native Mandarin speakers. They were paid for their participation.

Materials

A set of 23 video clips including spontaneous gestures were used as stimuli. The clips were extracted from the daily natural conversations in The NCCU Corpus of Spoken Mandarin. The experimental materials were clipped from 16 of the conversations. The particular advantage of these stimuli is that the subjects could perform the experimental task naturally as the gestures occurred in ordinary conversational scenes. The results can reveal people's natural comprehension of gesture. Each video clip lasted between 3 and 6 seconds in duration and contained a spontaneous gesture. While there could be two or three speakers in an interaction, an arrow pointing at the speaker who produced a target gesture was added in each clip.



There were three practice trials and they were incorporated with the test trials. In the experiment, the practice clips were shown before the test clips. The order of the test trials was arranged in a way iconic gestures of the same type did not appear consecutively.

Test trials			Practice trials		
Iconic gestures	action	5	Iconic gestures	action	1
	state	5		state	1
Self-adaptors		10	Self-adaptors		1

Procedure

The experiment took place in a quiet conference room at the university. A visible video camera was set on the left of the computer to record subjects' responses. Subjects were tested individually. They were told that they were taking part in an experiment that investigated how well college students understand daily conversations. Each subject signed an agreement that the experimental data can be used for research.

All practice and experimental clips were presented on a laptop computer, and subjects pressed the 'enter' key on the keyboard to finish the trials step by step. Subjects wore headphones and the

audibility of the speech in the clips was manipulated in two ways: 'audible' and 'inaudible', as confirmed among four graduate assistants. Eleven subjects were in the 'audible' group, in which speech was regarded by four assistants as 'clear' in the clips; nine were in the 'inaudible' group, in which speech was regarded as 'not clear'.

	Number of subjects
'audible' group	11
'inaudible' group	9

Subjects first read the instructions which provided a video sample showing people speak and gesture simultaneously and a brief overview of what kind of video clips the experiment involved and the appearance of an arrow. It was stated that speech may or may not be heard clearly and gestures may or may not be meaningful. It was also mentioned that the clips could be watched twice, and after viewing, verbal responses to questions had to be quick without delay. Subjects could ask the experimenter questions to ensure they understood the instructions completely. Then, the experiment started. The 23 trials were shown one by one. For each trial, after seeing a clip one or two times, the first question appeared: 'Regarding the speaker being pointed at in the clip, could you hear what the speaker said clearly?'. A quick verbal response was required before the next question. The following four questions were: 'Regarding the speaker being pointed at in the clip, what did the speaker say?', 'Regarding the speaker being pointed at in the clip, what hand movement did the speaker make?', 'Regarding the speaker being pointed at in the clip, was the hand movement meaningful?', and 'Regarding the speaker being pointed at in the clip, what did the hand movement mean?'. Similarly, a quick verbal response had to be provided after each question. The five questions were all answered before going to the next trial. The experiment took about 20 minutes on average. All responses were videotaped for later coding and analysis.

Speech coding

All the verbal responses were transcribed by native speakers of Mandarin Chinese. Responses to Question 1 and Question 4 were classified into one of three categories based on the response content.

Question 1: Regarding the speaker being pointed at in the clip, could you hear what the speaker said clearly?
Response categories: (1) clear, (2) fair, (3) not clear

Question 2: Regarding the speaker being pointed at in the clip, what did the speaker say?

Question 3: Regarding the speaker being pointed at in the clip, what hand movement did the speaker make?

Question 4: Regarding the speaker being pointed at in the clip, was the hand movement meaningful?
Response categories: (1) meaningful, (2) fairly meaningful, (3) meaningless

Question 5: Regarding the speaker being pointed at in the clip, what did the hand movement mean?

Data analysis & results

The responses to Question 2 were used to confirm the response categories in Question 1. Those to Question 3 were used to confirm the response categories in Question 4.

In the experiment, the first three trials were practices, and the responses were not considered.

In the experiment, although subjects participated either in the 'audible' or 'inaudible' situation, it turned out that some subjects could hear the 'inaudible speech' in some inaudible trials clearly; some regarded the 'audible speech' as 'not clear' in certain audible trials. Thus, the data analysis of whether speech was clear or not was based on subjects' own judgment.

Question 1: Regarding the speaker being pointed at in the clip, could you hear what the speaker said clearly?
Response categories: (1) clear, (2) fair, (3) not clear

Clear		Fair		Not clear		total
147	36.8%	51	12.8%	202	50.5%	400

For the purpose of the study, only 'clear' and 'not clear' responses were further analyzed.

Does speech clarity affect the comprehension of gestures?

Question 4: Regarding the speaker being pointed at in the clip, was the hand movement meaningful?
Response categories: (1) meaningful, (2) fairly meaningful, (3) meaningless

	meaningful		fairly meaningful		meaningless		**total**	
Clear	86	58.5%	5	3.4%	56	38.1%	147	100.0%
Not clear	84	41.8%	9	4.5%	108	53.7%	201	100.0%

chi-square = 9.504*, d.f. = 2, $p < .05$

Speech clarity influences subjects' understanding of gestures: When speech is clear, there is a statistically significant higher percentage of understanding gestures as meaningful manual actions.

Is there any difference between self-adaptors and representational gestures during comprehension with respect to speech clarity?

CLEAR	meaningful		fairly meaningful		meaningless		total	
Self-adaptors	9	14.3%	2	3.2%	52	82.5%	63	100.0%
Iconics	77	91.7%	3	3.6%	4	4.8%	84	100.0%

(meaningful vs. fairly meaningful vs. meaningless: chi-square = 94.029*, d.f. = 2, $p < .05$)

NOT CLEAR	meaningful		fairly meaningful		meaningless		total	
Self-adaptors	11	10.1%	6	5.5%	92	84.4%	109	100.0%
Iconics	73	79.3%	3	3.3%	16	17.4%	92	100.0%

(meaningful vs. fairly meaningful vs. meaningless: chi-square = 99.517*, d.f. = 2, p < .05)

The comprehension of self-adaptors and representational gestures differs:

- Speech clarity did not affect the comprehension of self-adaptors; most of them were understood as meaningless manual actions.
- Speech clarity affected the comprehension of representational gestures; more were regarded as meaningless when speech was not clear.

Within the category of representational gestures, is there any difference between gestures depicting actions and gestures depicting states during comprehension with respect to speech clarity?

The comprehension of actional and stative gestures differs:

- Speech clarity did not affect the comprehension of stative gestures; most of them were understood as meaningful manual actions.
- Speech clarity affected the comprehension of actional gestures; more were regarded as meaningless when speech was not clear.

CLEAR	meaningful		fairly meaningful		meaningless		total	
actions	51	98.1%	1	1.9%	0	0.0%	52	100.0%
states	26	81.3%	2	6.3%	4	12.5%	32	100.0%

(meaningful vs. fairly meaningful vs. meaningless: chi-square = 8.150*, d.f. = 2, p < .05)

NOT CLEAR	meaningful		fairly meaningful		meaningless		total	
actions	27	81.8%	2	6.1%	4	12.1%	33	100.0%
states	46	78.0%	1	1.7%	12	20.3%	59	100.0%

(meaningful vs. fairly meaningful vs. meaningless: chi-square = 2.098, d.f. = 2, p < .05)

Did subjects understand the intended meaning of the gestures?

For gestures depicting actions, the responses to Question 4 are as below:

Did subjects understand the intended meaning of the gestures depicting actions which were also regarded as meaningful?

	yes		no		total	
Clear	45	88.2%	6	11.8%	51	100.0%
Not clear	16	59.3%	11	40.7%	27	100.0%

(yes vs. no: chi-square = 8.696*, d.f. = 1, p < .05)

Did subjects understand the intended meaning of the gestures depicting states which were also regarded as meaningful?

	yes		no		total	
Clear	22	84.6%	4	15.4%	26	100.0%
Not clear	17	37.0%	29	63.0%	46	100.0%

(yes vs. no: chi-square = 15.2*, d.f. = 1, $p < .05$)

Speech clarity affected the comprehension of the intended meaning of representational gestures:

- When speech is clear, the understanding of the intended meaning is very high, 86.4% on average.
- When speech is not clear, the understanding of the intended meaning of the gestures depicting actions is reduced to 59.3%; that of the gestures depicting states is reduced to 37%.

To sum up,

- Self-adaptors were mostly understood as meaningless, but representational gestures were mostly understood as meaningful. Speech-gesture integration thus does not occur in processing self-adaptors.
- When speech was not clear, almost 80% of representational gestures were still regarded as meaningful. The result suggests that speech-gesture integration is not entirely obligatory.
- Speech clarity played a role in the comprehension of representational gestures: when speech was clear, more gestures depicting actions were regarded as meaningful, and the understanding of the intended gestural meaning, be it actional or stative, is very high.

Discussion

Why do people understand representational gestures as meaningful, even when they can't hear the accompanying speech clearly?

Dennett's (1987) notion of 'intentional stance'

Participants' responses reveal participants' common belief that the gesturers in the videos during face-to-face communication are rational and that their gestural behaviors are intentional actions that communicate semantic information. During comprehension, figuring out what the gesturers intend to convey is the participants' personal predictions about what the gesturers will do in a situation.

Motor cognition

Gesturing is overt motor behavior. Driven by motor resonance, the viewers matched each gesture against their own repertoire of gesture based on the similarity between the manual action of the gesturer and the actions of the participants in the past. Then, they presented their own predictions about what the interlocutor in the natural communicative scene had made certain gestures for.

Future studies

- Speech clarity: clear, not clear, absent.
- Types of gesture: emblems, self-adaptors, iconic actions, iconic states, metaphoric actions, metaphoric states.
- Why didn't speech clarity affect the comprehension of gestures depicting states?
- For the gestures being regarded as meaningful, in what ways would subjects interpret the meanings?

出席國際學術會議成果報告

計畫編號	NSC10000-2628-H-004-136-MY3
計畫名稱	隱喻概念與手勢
出國人員姓名 服務機關及職稱	國立政治大學英語系徐嘉慧教授
會議時間地點	2013/6/23 – 2013/6/28 University of Alberta, Canada
會議名稱	The 12th International Cognitive Linguistics Conference
發表論文題目	Mimicking Gestures and Joint Actions in Conversation

一、參加會議經過

The 12th International Cognitive Linguistics Conference (ICLC-12) 是每兩年舉辦一次的認知語言學會議，包括論文的發表及專題研討會。本次會議有三場論壇，分別邀請國際知名認知語言學家，討論認知語言學之「looking back」、「looking forward」和「looking outward」。很多發表的論文都與本人的研究有關，包括 metaphor、metonymy、grammaticalization、frame semantics 等議題；也有手勢方面的論文。本人參與的場次為 6 月 24 日的「Language, Body, and Cognition: A Look at Action Formation in Chinese Spoken Discourse」，著重討論語言的使用跟身體、手勢、眼神有著緊密關係，本人發表的論文為 Mimicking Gestures and Joint Actions in Conversation。

二、與會心得

ICLC-12 讓本人獲益良多，可以瞭解認知語言學的新發展，包括新的研究議題、新的研究結果。本人近期的研究「隱喻概念與手勢」，這是屬於認知語言學範疇。ICLC-12 也包括手語和手勢的論文發表，都是本人研究所關心的議題，也看到手語和手勢的研究跟語言學、認知心裡學有密切關係。手語和自然手勢的研究雖然是新趨勢，但是目前投入的研究非常少，需要大家更多的努力。

Mimicked Gestures and Joint Establishment of Meaning in Conversation

Kawai Chui 徐嘉慧
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June 23, 2013

Purpose of the study

- To investigate how mimicked gestures collaborate with speech to accomplish the **joint establishment of meaning for the same reference** in daily face-to-face conversation, when participants are free to talk about any topics of interest in their own way **without topic assignment and video stimuli**; they also develop joint actions naturally.

Data for the current study

- Eight conversational excerpts among adult native speakers of Mandarin Chinese, totalling about 160 minutes of talk.
- Twelve instances of mimicked gestures were found.
- Gestural repetition is not frequent in daily conversation.

- One reason: Speakers **perform many actions** other than talking about the meaning of the same reference.

- Another reason: Speakers **do not necessarily mimic others' gestures** when they present semantic information about the same reference.

Domain of analysis

The joint establishment of meaning involves **a course of action**, as realized by a stretch of talk that includes:

- **the beginning and the end of the discussion** about the meaning of a reference across speakers
- **a pair of similar gestures** produced by different speakers to depict the same reference

Three sequential phases of the joint action

- **Initiation phase**: the contextual situation that would prompt the initiation of the joint action.
- **Execution phase**: a mimicked gesture collaborates with speech to create meaning for the original gesture reference.
- **Completion phase**: the new meaning is recognized and accepted and the joint action is ended.

What kinds of contextual situation as manifested in the first speaker's turn would initiate the joint establishment of meaning in the next turn?

Difficulty in verbalization

Topic: Idealization of a person

Joint action: establish meaning for the idea of *lǐxiǎnghuà* ‘idealization’

Initiation phase

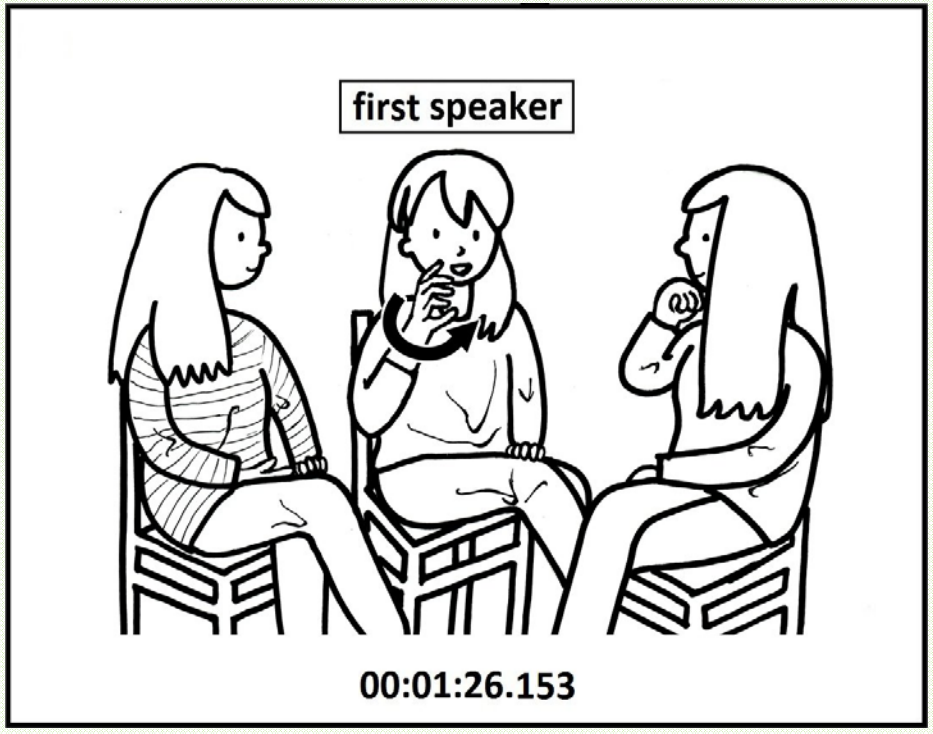
First speaker's speech

"If a person were someone with whom she failed to establish a close relationship with, s/he would idealize the person."

..你得不到的東西..然後一直對他很..理想化的..很

First speaker's gesture

Turn the hand clockwise to depict the change in the process of lǐxiǎnghuà



- Then, the first speaker attempts to further explicate what she means by idealization yet **fails to finish her idea** after uttering the second degree adverb *hěn* ‘very’

..你得不到的東西..然後一直對他很..理想化的..很

- The failure prompts the other speaker to provide meaning for the idea of idealization.

Execution phase

Second speaker's speech

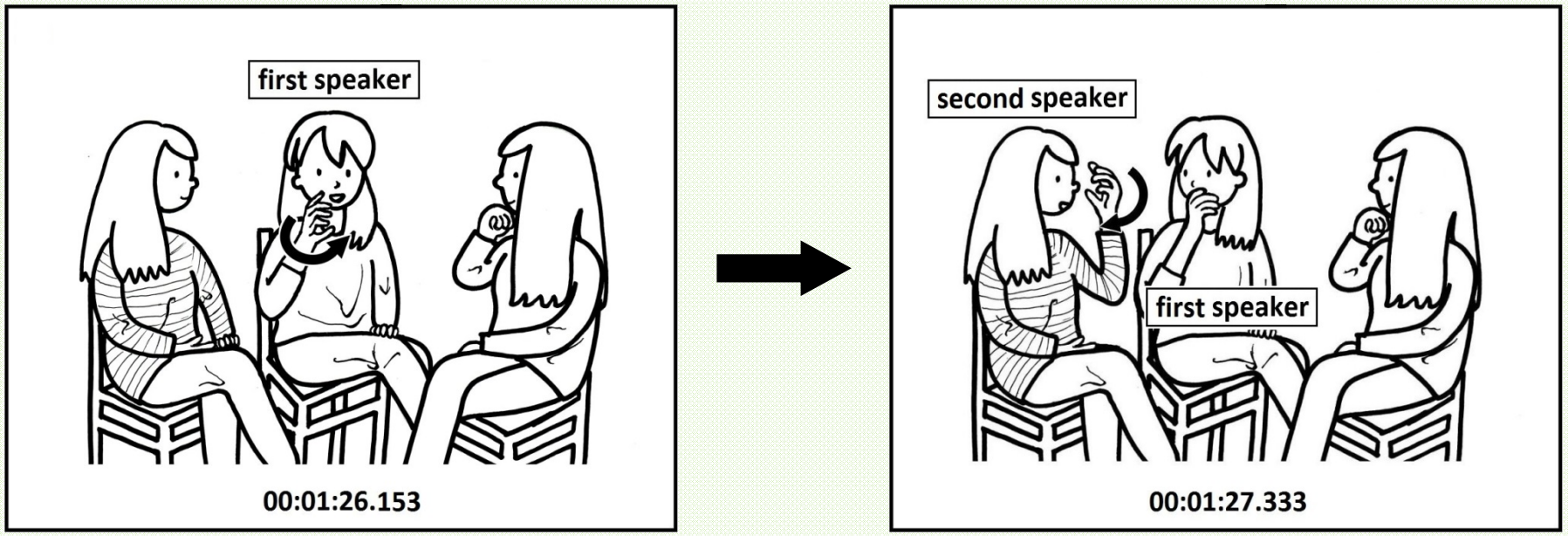
She does not finish the first speaker's incomplete utterance, but to formulate a new assertion.

"You beautify him."

…(0.3)你把他美化

Second speaker's gesture

Rather than depicting měihuà, she mimics the same lǐxiǎnghuà gesture.



Lack of clarity

New references are expressed by demonstratives, non-conventional ideophones, or homonyms.

Topic: The body shape of a friend

Joint action: establish meaning for the demonstrative *nàge* ‘that’

Initiation phase

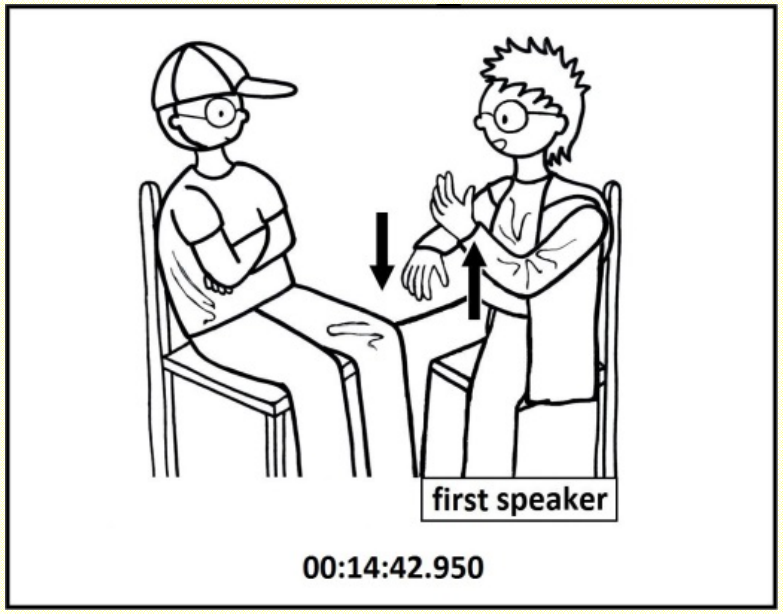
First speaker's speech

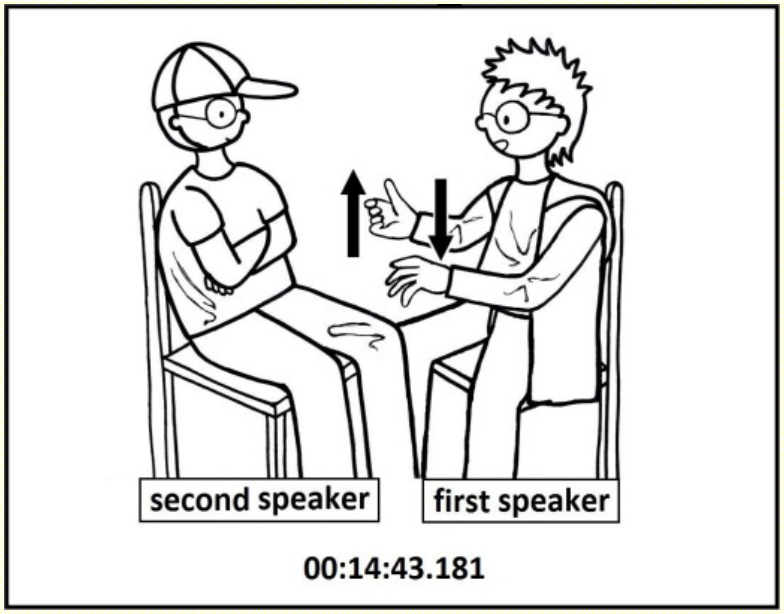
"Actually she was originally quite good at that."

..其實她本來就蠻會那個啊

First speaker's gesture

Both hands move up and down four times from the left to the right, depicting the idea of the **changes in the body shape**.





- The absence of an explicit lexical meaning for the new gestural reference in the prior context prompts the other participant to provide a new meaning for the demonstrative.

Execution phase

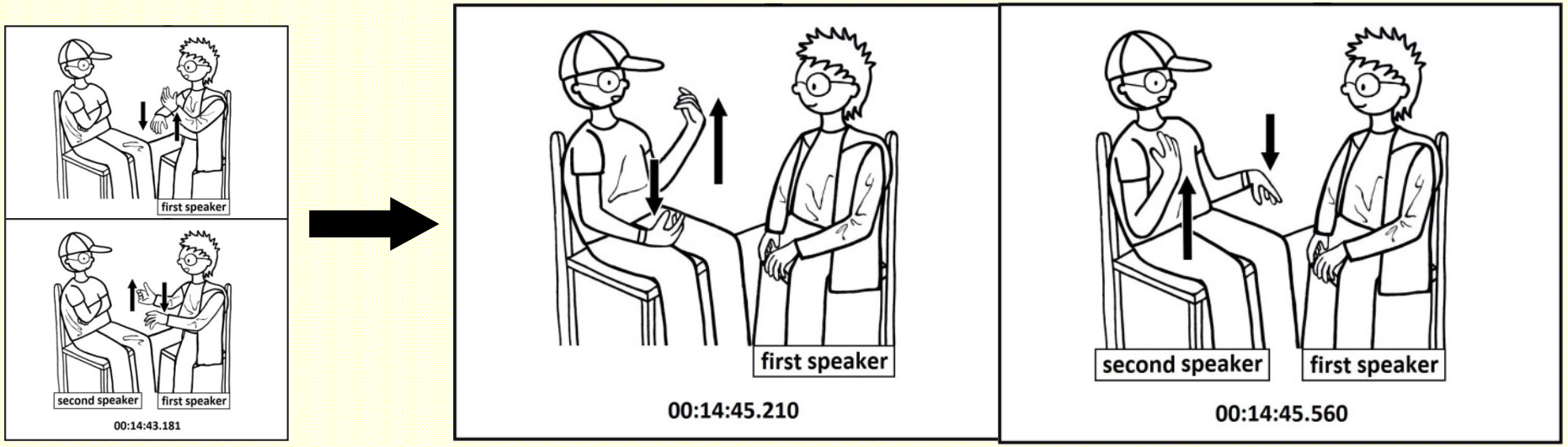
Second speaker's speech

"(She) is quite good at adjusting her body shape."

..還蠻能調節就對了

Second speaker's gesture

He mimics the body-shape-adjustment gesture.



Alignment

Topic: Feeling itchy during the harvesting of crops in a field

Joint action: establish meaning for prickles *máng* on the crops

Execution phase

First speaker's speech

"Because it has prickles."

. . .因為它有芒啊

First speaker's gesture

It enacts holding the stem of a crop on which there are prickles.

- The other participant supports the idea by providing more information about the same gestural reference *máng* in the next turn.

Execution phase

Second speaker's speech

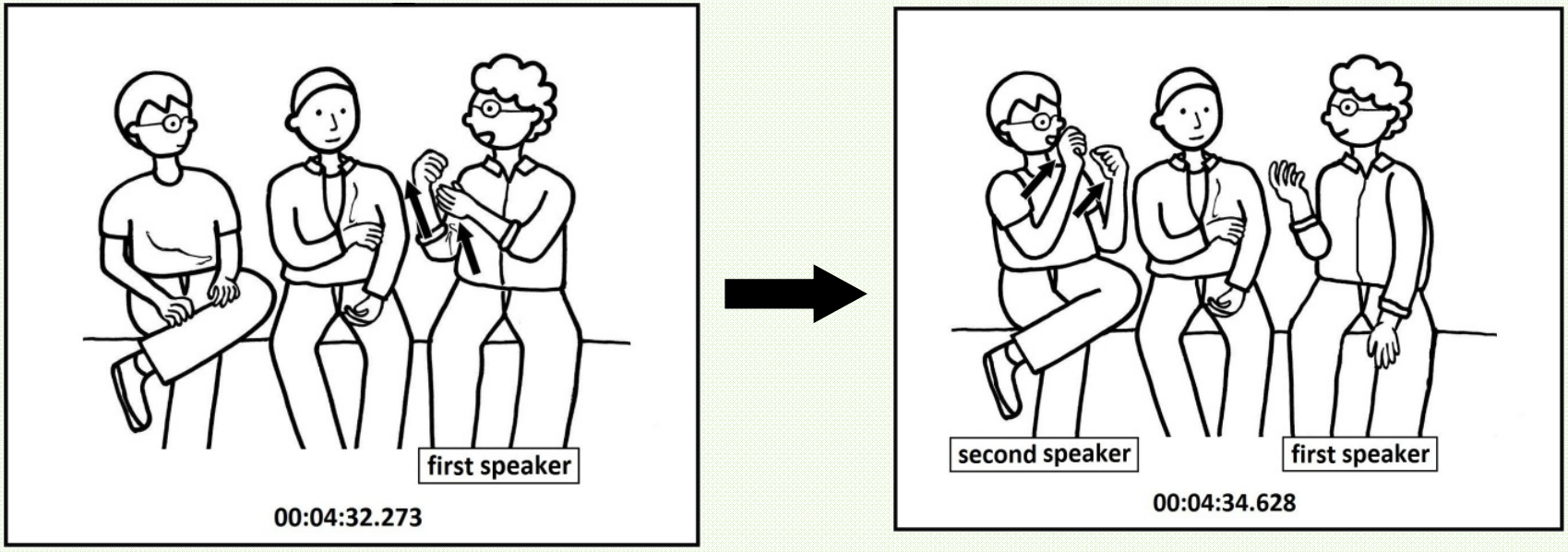
She provides additional characterization of the crops - having *háomáo* 'fine hair' on the stems.

"There is fine hair on (it)."

..上面有那個..毫毛

Second speaker's gesture

He mimics the holding-a-stem gesture.



Disagreement

Topic: The kind of musical instrument a character in a movie plays

Joint action: establish the reference for *yuèqí* 'musical instrument'

Execution phase

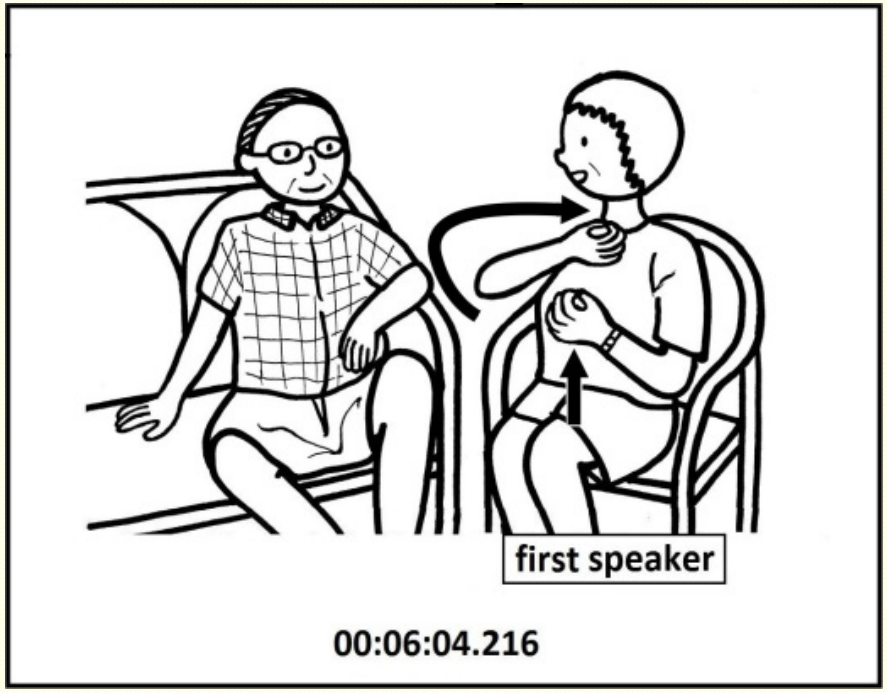
First speaker's speech

"Maobo (used) that kind of professional musical instrument, you know."

..茂伯他說..茂伯是那種...專業的那種...樂器的..你知道嗎

First speaker's gesture

It enacts playing a stringed musical instrument that requires the use of a bow.



- Since the other participant holds a contrary opinion about the reference *yuèqí* in regard to the instrument played in the movie, he then brings up a different understanding in the next turn.

Execution phase

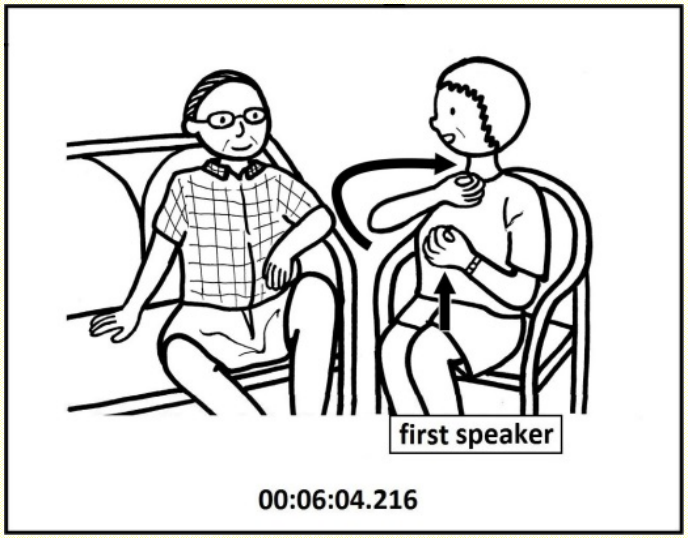
Second speaker's speech

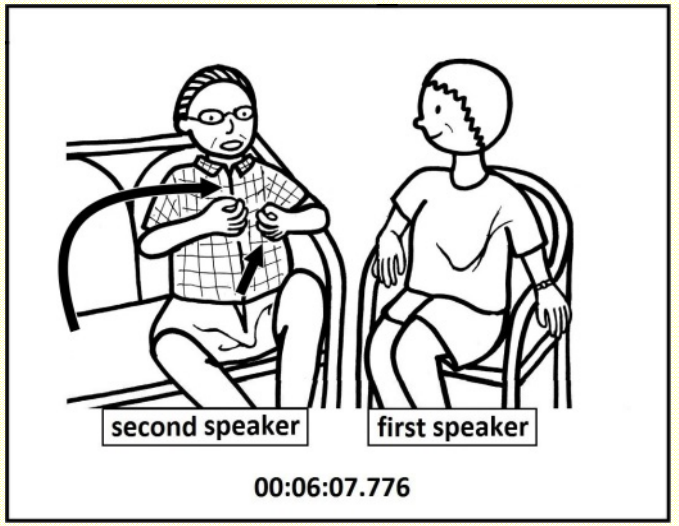
"No, he played a kind of plucked lute with a wooden body." ((play with fingers))

沒有..他是那個...(1.1)鋸絃仔((彈月琴的))

Second speaker's gesture

He mimics the gesture depicting the kind of musical instrument that needs a bow.





In the third year, another experiment on the comprehension of metaphoric gestures was conducted. There were numerous studies on people's understanding of metaphoric speech based on behavioral and neuroimaging experiments. In the behavioral studies, among many others, Gibbs and colleagues (2006a, 2006b, 2007, 2013) found that engaging in or imagining appropriate body movements facilitated the comprehension of certain metaphorical phrases; participants could create embodied simulations for metaphorical phrases; metaphor processing did not necessarily take additional effort in neutral contexts; particular contexts could make novel metaphors more accessible; people's interpretations of simple narratives could rely on their embodied understandings of the metaphors involved.

The ERP studies of metaphor comprehension employed various types of stimuli, including literally true, literally false and metaphorically true sentences in Glucksberg, Gildea & Bookin (1982); familiar and unfamiliar metaphors and literal sentences in Pynte et al. (1996); literals, literal mappings and metaphors in Coulson & Van Petten (2002); high-cloze literals, low-cloze literals and metaphors in Coulson & Van Petten (2007). These studies found that metaphorical meanings were activated very early in the processing stream (Glucksberg, Gildea & Bookin 1982); literal and metaphoric processing had no qualitative difference in brain activity but the relevance of the context did affect the ERPs (Pynte et al. 1996); there was a gradient of processing difficulty (Coulson & Van Petten 2002); both hemispheres were similarly sensitive to metaphoric meaning (Coulson & Van Petten 2000, 2002).

For the studies of gesture comprehension, short videos displaying sentences with co-occurring gestures were provided in experiments. Kelly et al. (2004) found that incongruous hand gestures produced a larger N400 component than congruous hand gestures, suggesting that gestural information was integrated into discourse at a very early stage of language processing. Kelly et al. (2007) manipulated participant's knowledge about whether gesture and speech were intended to go together; they found that the intentional relationship between gesture and speech affected the neural processes. Wu & Coulson (2005, 2007) also found that the N400 effect was sensitive to both linguistic ad gestural contexts. For cross-modal comprehension of metaphors, Cornejo's (2009) experiment included bodily gestures that were either congruent or incongruent with the metaphorical meaning of the expressions. Gestural and speech information were found to be combined online to make sense of the interlocutor's linguistic production at an early stage of metaphor comprehension.

While incongruent gestures seldom occur in daily conversation, the present project rather examined the frequently occurring iconic gestures which are semantically related to the content of the associated speech, and self-adaptors which

are not related to the content of the speech, such as the self-grooming gestures. Our experiment also investigated whether there was a gradient of processing difficulty across four types of statements including metaphors and different types of literals, to understand whether people's understanding of metaphoric statements differs from that of other types of literal sentences, whether gesture would facilitate comprehension of language, and whether there is gender difference in language-gesture comprehension.

Experimental stimuli: linguistic materials

In Coulson & Van Petten (2000, 2002), three types of sentences, namely literals, literal mappings and metaphors, were used in their study of metaphor comprehension. In their ERP experiments, the three sentence types shared a similar wave shape and scalp topography, but demonstrated a gradient of processing difficulty, with the literals having the least N400 effect, the metaphors the most N400 effect, and the literal mappings in between. To test the gradient of processing difficulty during linguistic-gestural processing, our experiment included four types of sentences. Each type consisted of 25 statements with the target words at the end. The final target words were the same across the four types, totally 100 statements. The number of words ranged from 5 to 11 words.

1. 'Metaphor': the last target word is used metaphorically, with some correspondence between two semantic domains. Take '這裡的信心危機是海嘯' for example. Some semantic features in the domain of tsunami '海嘯' correspond with those in the domain of crisis of confidence '信心危機'.
2. 'Literal mapping': the last target word is used literally, also with some correspondence between two semantic domains. In '科學家誤判這次的巨浪是海嘯', the literal understanding of '海嘯' in the statement requires some cross-domain correspondence between the target word and '巨浪'.
3. 'Literal [-prompt]': the last target word is used literally; it is not semantically related to the other words in the sentence, as in '科學家希望徹底瞭解海嘯'.
4. 'Literal [+prompt]': the last target word is used literally; it is semantically related to some other words in the sentence, based on category membership. For example, '海嘯' and '海底地震' in '海底地震會造成海嘯' are related.

To test whether participants understood the experimental statements, each was matched with one 'related' and one 'unrelated' sentence. In total, there were 100 'related' and 100 'unrelated' statements. The number of words in the related statements ranged from 3 to 9 words; that in the unrelated statements was from 4 to 8. Examples are provided below:

	METAPHOR	LITERAL MAPPING
stimulus	這裡的信心危機是海嘯	科學家誤判這次的巨浪是海嘯
related	信心問題具有大規模摧毀力	水災具有大規模摧毀力
unrelated	信心問題需要解決方案	水災檢驗社會的防備能力
	LITERAL [-prompt]	LITERAL [+prompt]
stimulus	科學家希望徹底瞭解海嘯	海底地震會造成海嘯
related	科學家想研究大規模的摧毀力	地震具有大規模摧毀力
unrelated	科學家想研究地球的未來	地震可檢驗社會的防備能力

Experimental stimuli: gestural materials

Three conditions concerning the use of gesture were included in the experiment for the understanding of whether gesture would facilitate language comprehension, whether there was any difference between the use of iconic gestures and self-adaptors, and whether there was gender difference. Each experimental statement was uttered and gestured by an actress who rehearsed to keep her speech and gesture productions constant across the four conditions. The productions were situated in an interactional environment with an addressee who acknowledged the performer's production by nodding one time.

1. Speech-only condition: The statements were presented by speech without gesture. The performer put her hands on her lap while speaking. See the screenshot below:

2. Iconic-gesture condition: Every target word was accompanied by an iconic gesture that was semantically close to the meaning of the target word. The gesture depicted the meaning related to the target word, which was also verbalized in the 'related' statement. For instance, the gesture for '海嘯' was the horizontal movement of the right hand from the center to the right periphery and back to the center for enacting a large extent of influence of a tsunami. The gesture was also associated with the meaning of '大規模' in the 'related' statements. See the screenshots of the gesture in Fig 1. The performance was videotaped on a SONY camcorder.

The semantic relatedness between speech and gesture was then rated by 40 undergraduates who did not participate in the experiment. They watched the video clips and then performed a pencil-and-paper task of rating whether the action in each of the clips was semantically related to speech. The scale ranged from 1 to 5, where 1 was *very high (degree of relatedness)*, 2 was *somewhat high*, 3 was *neutral*, 4 was *somewhat low* , and 5 was *very low*. The mean rating was 1.7.

3. Self-adaptor condition: Every target word was accompanied by some self-grooming movements that were not meaningful with respect to the statements, like scratching oneself or adjusting one's clothes, hair, or glasses. The self-adaptor that accompanied '海嘯' was the adjustment of the performer's own hair. See the screenshots below:

In total, there were 300 video clips for the study. They ranged in length from 3 to 7 seconds.

Participants

Forty-nine undergraduate students from the National Chengchi University population, 25 males and 24 females, took part in the experiment. Participants were recruited through the university announcement system, and were from a wide range of academic departments. All participants were native Mandarin speakers; all right-handed with normal visual acuity. None had any reported history of neurological or psychiatric disorders.

Procedure

Participants took the listening and reading span tests of working memory before the experiment. Then, they watched video clips displayed on a monitor. Each clip lasted 6 seconds on average. After about 1 second of blank screen, a comprehension statement appeared in its entirety for 10 seconds. The participants responded 'related' or 'unrelated' via a buttonpress with their right hands. After

each comprehension statement, there were 2 seconds of blank screen before the beginning of the next trial. Four practice trials were provided before the experimental session began. Each session included 25 experimental trials and 10 control trials presented in random order. Each experimental session lasted for 30–45 minutes

Findings and discussion

The experimental study aimed to provide answers to questions about the use of gesture in speech comprehension, specifically metaphor comprehension. The research questions are as follows:

- Does the comprehension of metaphoric statements differ from that of literal mapping, literal [-prompt] and literal [+prompt], when gesture does not occur?
- Do iconic gestures facilitate the understanding of metaphoric statements and the other three types of literal statements?
- Do self-adaptors facilitate the understanding of metaphoric statements and the other three types of literal statements?
- Within each type of statements, do iconic gestures facilitate comprehension?
- Is there gender difference in the comprehension of metaphoric and literal statements, with or without gesture?

The answers to the above questions rest upon statistical analysis of participants' reading times and accuracy rates. The accuracy rates across the four types of statements were: 73.2% for 'metaphor'; 69.3% for 'literal mapping; 70.5% for 'literal [-prompt]'; 73.8 % for 'literal [+prompt]. Statements followed by incorrect answers were not included in the analyses below. One-way ANOVA was used to test for differences among reading times; Generalized Linear Model was used to test for differences among accuracy rates.

Does the comprehension of metaphoric statements differ from that of literal mapping, literal [-prompt] and literal [+prompt], when gesture does not occur?

In the speech-only condition, the video stimuli did not include any gestures or self-adaptors. The mean reading times and accuracy rates are indicated in Table 1. The statistical differences among the reading times across the metaphoric and three types of literal statements were not significant; those among the accuracy rates were significant.

Table 1. Speech-only condition: reading times and accuracy rates

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
2691.979	2636.154	2732.024	2847.97

F(3, 64)=0.1638, p=0.9203 >0.05

Speech-only condition: accuracy rates

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
71.7742%	64.2276%	80.4878%	72.6415%
$X^2(3)=8.2456$, p=0.0412 <0.05			

Do iconic gestures facilitate the understanding of metaphoric statements and the other types of literal statements?

In the iconic-gesture condition, the mean reading times and accuracy rates are shown in Table 2. Again, the statistical differences among the reading times across the metaphoric and three types of literal statements were not significant; those among the accuracy rates were significant.

Table 2. Iconic-gesture condition: reading times and accuracy rates

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
2385.822	2967.029	2727.148	2488.122
F(3, 122) = 1.5258 , p= 0.2112 >0.05			

Iconic-gesture condition: accuracy rates

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
78.7879%	67.1875%	60.6061%	71%
$X^2(3)=10.873$, p=0.0124 < 0.05			

Do self-adaptors facilitate the understanding of metaphoric statements and the other three types of literal statements?

In the self-adaptor condition, the mean reading times and accuracy rates are demonstrated in Table 3. The statistical differences across the metaphoric and three types of literal statements were not significant.

Table 3. Self-adaptor condition: reading times and accuracy rates

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
2926.58	3050.224	2721.776	2786.161
F(3, 124)= 0.1101, p= 0.954 >0.05			

Self-adaptor condition: accuracy rates

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
68.9394%	78.6408%	71.7557%	76.2195%
$X^2(3)=3.6444$, p=0.3025 >0.05			

Within each type of statements, do iconic gestures facilitate comprehension?

Table 4 shows the reading times and accuracy rates in each type of sentences vis-à-vis the speech-only, iconic-gesture, and self-adaptor conditions. The facilitation of iconic gestures was found only in metaphor comprehension, in that subjects took less time to provide correct responses to the comprehension questions, and the accuracy rate was higher when iconic gestures depicted the target words. The gesture effect was absent in the comprehension of the other three types of literal statements.

Table 4. Reading times and accuracy rates in the four types of statements

Metaphor: reading times

NO GESTURE	ICONIC GESTURE	SELF-ADAPTOR
2691.979	2385.822	2926.585

$F(2, 78)= 1.5175$, $p= 0.2257 >0.05$

Metaphor: accuracy rates

NO GESTURE	ICONIC GESTURE	SELF-ADAPTOR
71.7742%	78.7879%	68.9394%

$X^2(2)=3.518$, $p=0.1722 >0.05$

Literal mapping: reading times

NO GESTURE	ICONIC GESTURE	SELF-ADAPTOR
2636.154	2967.029	3050.224

$F(2, 78)=0.1567$, $p=0.8552 >0.05$

Literal mapping: accuracy rates

NO GESTURE	ICONIC GESTURE	SELF-ADAPTOR
64.2276%	67.1875%	78.6408%

$X^2(2)=6.2275$, $p=0.04443 <0.05$

Literal [-prompt]: reading times

NO GESTURE	ICONIC GESTURE	SELF-ADAPTOR
2732.024	2727.148	2721.776

$F(2, 78)=0.137$, $p=0.8721>0.05$

Literal [-prompt]: accuracy rates

NO GESTURE	ICONIC GESTURE	SELF-ADAPTOR
80.4878%	60.6061%	71.7557%

$X^2(2)=12.368$, $p=0.002062 <0.01$

Literal [+prompt]: reading times

NO GESTURE	ICONIC GESTURE	SELF-ADAPTOR
2847.97	2488.122	2786.161

$F(2, 76)=1.2133$, $p=0.3029 >0.05$

Literal [+prompt]: accuracy rates

NO GESTURE	ICONIC GESTURE	SELF-ADAPTOR
72.6415%	71%	76.2195%

$X^2(2)=0.97652$, $p=0.6137 >0.05$

Is there gender difference in the comprehension of metaphor and litereal statements, with or without gesture?

25 males and 24 females participated in the experiment. Table 5 shows that gender difference was not found in the four types of statements. The only exception is: When participants were presented with literal-mapping stimuli without gestures, male subjects provided significantly more accurate responses.

Table 5. Gender and gesture across different types of statements

Speech-only condition: reading times

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
F: 2796.792 M: 2598.813	F: 2649.348 M: 2624.426	F: 2784.574 M: 2685.313	F: 2884.398 M: 2815.589
F (1, 15)=0.1644 p=0.6909 >0.05	F (1, 15)= 0.0269, p=0.8719 >0.05	F (1, 15)= 0.1202, p=0.7337 >0.05	F (1, 15)= 0.1086, p=0.7463 >0.05

Speech-only condition: accuracy rates

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
F: 72.4138% M: 71.2121%	F: 51.7241% M: 75.3846%	F: 74.1379% M: 86.1538%	F: 72% M: 73.2143%
$X^2(1)=0.22018$, p=0.882 >0.05	$X^2(1)=7.5307$, p=0.0061 <0.01	$X^2(1)=2.8295$, p=0.0925 >0.05	$X^2(1)=0.019589$, p=0.8887 >0.05

Iconic-gesture condition: reading times

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
F: 2097.401 M: 2674.244	F: 2836.302 M: 3097.755	F: 2525.078 M: 2929.219	F: 2268.7 M: 2707.544
F (1, 30)= 1.4852, p=0.2325 >0.05	F (1, 30)= 0.2931, p=0.5922 >0.05	F (1, 30)= 0.2105, p=0.6497 >0.05	F (1, 28)= 0.831, p=0.3698 >0.05

Iconic-gesture condition: accuracy rates

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
F: 80.303% M: 77.2727%	F: 67.1875% M: 67.1875%	F: 60.6061% M: 60.6061%	F: 72% M: 73.2143%
$X^2(1)=0.18144$, p=0.6701 >0.05	$X^2(1)=0$, p=1.0000 >0.05	$X^2(1)=3.5527$, p=1.00000 >0.05	$X^2(1)=0.04377$, p=0.5082>0.05

Self-adaptor condition: reading times

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
F: 2286.294 M: 3566.877	F: 2628.927 M: 3471.521	F: 2609.682 M: 2833.87	F: 2530.537 M: 3041.785
F (1, 30)= 5.9055, p=0.01786 <0.05	F (1, 30)= 2.0735, p=0.1602 >0.05	F (1, 30)= 0.5723 p=0.4553 >0.05	F (1, 30)= 1.8666, p=0.182 >0.05

Self-adaptor condition: accuracy rates

METAPHOR	LITERAL MAPPING	LITERAL [-prompt]	LITERAL [+prompt]
F: 66.6667% M: 71.2121%	F: 82.6923% M: 74.5098%	F: 74.2424% M: 69.2308%	F: 76.8293% M: 75.6098%
$X^2(1)=0.31863$, p=0.5724 >0.05	$X^2(1)=1.0305$, p=0.31 >0.05	$X^2(1)=0.40614$, p=0.5239 >0.05	$X^2(1)=0.033644$, p=0.8545 >0.05

4. Conclusion

The three-year project has investigated the production and comprehension of metaphoric gestures in Chinese discourse to understand how people conceptualize concepts in a metaphorical way and understand metaphorical ideas in their daily communication. First, the linguistic-gestural representation of conceptual metaphors in daily Mandarin Chinese conversations helps understand whether there are commonly used metaphors for the expression of abstract ideas, and whether cross-modal representation differs from gesture-only representation of conceptual metaphors. A sizable amount of data demonstrates that metaphoric gestures with literal speech are as common as metaphors in both speech and gesture. Nine types of metaphors were identified, namely Body-part, Causation, Conduit, Container, Entity, Fictive-motion, Orientation, Personification, and complex metaphors, among which the Entity metaphor and Orientation metaphor constitute the majority. With regard to the one-source-to-many-targets correspondences, the source domains of OBJECT, SPACE, PATH, FICTIVE-MOTION, ACTIVITY, and CONTAINER were used to conceptualize numerous abstract concepts, with OBJECT being the most common source domain concept. As to the many-sources-to-one-target correspondences, the

target-domain concepts of TIME, MENTAL ACTIVITY, SPEECH CONTENT, SEQUENCE, and DEGREE could be represented by many source-domain concepts. The findings provide evidence that conceptual metaphors are readily depicted by gesture. Moreover, the prevalent use of the Entity and Orientation metaphor, whether by single or both modalities, manifests the entrenchment and the broad realization of the image schema of OBJECT, PATH and SPACE. The one-source-to- many-targets and many-sources-to-one-target correspondences indicate the context-dependent and dynamic use of metaphors in daily communication. Finally, the findings can shed light on the cognitive modeling of speech-gesture production. The collaboration of language and gesture in the representation of metaphor supports the Interface Hypothesis of speech-gesture production (Kita & Öyzürek 2003). On the one hand, the spatio-motoric and linguistic information interact with each other, so that gesture and the associated speech would occur at the same time. In the data, the occurrence of the temporal synchronization of language and gesture in the expression of metaphor is high (84.6%). On the other hand, the hypothesis accounts for the 55.5% of metaphoric expressions being realized only in gesture with literal speech. As a result, the two modalities can covey diverse semantic content.

The experiments on the comprehension of metaphoric gestures provided preliminary results about the facilitation of gesture in the understanding of metaphoric and various types of literal statements, and also about gender difference. It was found that iconic gestures facilitated only the comprehension of metaphoric statements. The three types of literals did not manifest a gradient of processing difficulty, with or without gesture. Gestures that were not relevant to the meaning of the statements did not affect the language comprehension. Finally, males and females, by and large, behaved similarly, be gesture present or absent.

In the future, it is hoped that neuroimaging experiments could be carried out to understand the on-line semantic integration of speech and gesture during language comprehension.

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Comprehension of Representational Gestures

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Abstract

In daily communication, the spontaneous use of hands and arms along with speech is pervasive and indispensable. The present study used real face-to-face communication materials as stimuli to investigate the comprehension of representational gestures when speech is not available. Twenty-two adults watched short, soundless video clips extracted from recordings of daily conversations, each including a spontaneous representational gesture. Participants were requested to judge whether and in what way the gestures made sense. Their responses showed that in the absence of speech, the idiosyncratic hand configurations were not incomprehensible, suggesting that speech-gesture integration is not entirely obligatory. The way representational gestures were understood in this study reveals the activated content of the gestural-action representations which consists of conceptual knowledge associated with a situation of use.

Keywords: representational gestures; speech-gesture integration; gestural-action representations

Introduction

Representational gestures are the 'gesticulation' type in Kendon's continuum of manual production in verbal communication with the following features: obligatory presence of speech, linguistic properties absent, not conventionalized, global and synthetic (McNeill 2000). In daily communication, the spontaneous use of hands and arms along with speech is pervasive and indispensable when people engage in conversational talk (McNeill 1992, 2000; Goldin-Meadow 1999; Kendon 2004). "The tremendous overlap between neural structures contributing to language and hand/arm movement may help to explain the prevalence of hand gesture in language" (Glenberg 2007: 363). When the speaker conveys a message, speech and gesture often work in collaboration to express similar information or different but related information. The integrated relationship between speech and gesture is supported by "studies from the field of cognitive neuroscience [which] complement the work from psychology – gesture influences the behavioral processing of speech during language production and comprehension, and one explanation for this behavioral finding is that gesture and speech are integrated in space and time in the brain's processing of this information" (Kelly et al. 2008: 6-7; also Kelly et al. 2004, 2010; Wu and Coulson 2007). Nevertheless, speech-gesture integration was also found to be affected by the amount of observed meaningful hand movements (Holle and Gunter 2007), people's knowledge about intentionality (Kelly et al. 2007), and the strength of the semantic incongruence between the two modalities (Kelly et al. 2010). Thus, whether the integration is obligatory and automatic in comprehension is still an open question. Moreover, the previous studies addressed the integrated relationship without considering obstacles to communication.

Face-to-face interaction is not always successful. Barriers to successful communication occur because of various kinds of communication noise, namely physical noise, physiological noise, psychological noise, and semantic noise (Rothwell 2010), so that the speaker may fail to convey the message in speech. When this phenomenon occurs, a question then arises: Can people still comprehend the co-occurring representational gestures in the absence of speech? To answer this question, the present study first put aside the consideration of the prior linguistic context and the various extent to which speech could be affected by communication noise, as a large body of studies have already attested the integration of speech and gesture during language comprehension, so that the integration can be expected in the presence of linguistic context and speech, be it clear or not. This study considered the situation in which both linguistic context and accompanying speech are not available, to provide baseline findings for future research on the influence of various degrees of clarity of speech with or without context. Back to the question: Can people comprehend co-occurring gestures without speech? One possible answer is *no*. "These gestures are spontaneous creations of individual speakers, unique and personal….[t]hey are not fixed. They are free to reveal the idiosyncratic imagery of thought. Yet, at the same time, such gestures and the images behind them coexist with speech" (McNeill 1992: 1). Thus, in the production of gesture, the presence of speech is obligatory (McNeill 2000, 2011); in language comprehension, the integration of speech and gesture is both mutual and obligatory (Kelly et al. 2004, 2008, 2010; Bernardis and Gentilucci 2006; Özyurek et al. 2007; recent reviews in Kelly et al. 2007, 2008). Without accompanying speech, spontaneous and idiosyncratic gestures are incomprehensible. Nevertheless, with regard to Dennett's (1987) notion of 'intentional stance' and the behavioral, neurophysiological, and brain-imaging studies of motor cognition (see the reviews in Fischer and Zwaan 2008), it is possible that gestures in the absence of speech can still be comprehensible. On the one hand, under the belief that the person who produces gestures is a rational agent, the viewer of the gesture would consider the use of the gestural behavior to be an intentional action. On the other hand, driven by motor resonance, mental simulation of

the goal-directed actions can be carried out for understanding (Sommerville and Decety 2006; Fischer and Zwaan 2008; Gentilucci and Voltra 2008; Taylor and Zwaan 2008). In the same way, "when we observe another individual acting, we strongly 'resonate' with his or her action" (Fadiga et al. 2005: 214). The viewer of the gesture can comprehend the intentional manual actions by simulating his/her own behaviors in the past.

This study conducted an experiment to examine whether representational gestures are comprehensible in a natural, common communicative situation where speech is not available. The distinction between gestures associated with lexical expressions, such as the running-continuously gesture in Example (1), and those conveying complementary information, like the finding-seat-locations gesture in Example (2), was not necessary when speech was not provided in the experiment. Concerning the experimental materials for the study of language and gesture comprehension, Cassell et al. (1999) used spontaneous narrative segments including naturally occurring gestures as stimuli. Kelly et al. (2004: 259) "used an *audiovisual* presentation of language stimuli—a presentation that more closely approximates normal face-to-face communication than previous ERP studies on language processing." The materials in Wu and Coulson (2007) were spontaneous discourse segments including speech and gestures. In the present study, interactional segments clipped from real daily face-to-face conversations involving spontaneous gestures were used as stimuli. The particular advantage of these stimuli is that the subjects could perform the experimental task naturally as the gestures occurred in ordinary conversational scenes. The results can reveal people's natural comprehension of gesture.

Under the condition that speech was not available, participants had to judge whether and in what way the gesture targets in the interactions were meaningful. Provided that gesture and speech primarily combine during language production and comprehension (McNeill 1992; Kendon 2004; Kelly et al. 2004, 2008, 2010; Bernardis and Gentilucci 2006; Özyurek et al. 2007), the two modalities must form a very tightly integrated system of communication by nature if gestures cannot be understood without speech. In contrast, if gestures are comprehensible, the integrated relationship can then be changed in certain communication situations. The way gestures are understood discloses the way they are represented. This study of the comprehension of gesture can provide insights into the nature of speech-gesture integration and gestural-action representations.

Method

Participants

Twenty-two right-handed university undergraduates, aged from eighteen to twenty-two, participated in the experiment. Fourteen were females; eight were males. They were native Mandarin speakers. They were paid for their participation.

Materials

A set of eight video clips including spontaneous gestures were used as stimuli. The clips were extracted from the daily natural conversations in The NCCU Corpus of Spoken Chinese. The corpus is of a collection of spoken forms of Mandarin, Taiwanese, and Hakka in Taiwan (Chui and Lai 2008). The sub-corpus of spoken Mandarin contains short oral narratives and daily face-to-face conversations.[1] The experimental materials were clipped from four of the conversations.

Each video clip lasted between 3 and 6 seconds in duration and contained a representational gesture. All the target gestures are of the 'gesticulation' type in Kendon's continuum of manual production in verbal communication. The experiment consisted of eight gesture targets.

Procedure

The experiment took place in a quiet classroom with a 180cm x 240cm projector screen at the university. The participants were tested together, and all of them could see the screen in its entirety. The video clips were presented one at a time. Each was played without sound for five to ten times until all of the participants reported that they were clear about the manual configurations in the stimuli. The participants were then asked to provide responses to two questions for each gesture target after the end of each clip: (1) What is the meaning of the gesture, if any? (2) What could be the subject matter of the talk in which the gesture occurs? The task required the participants to make judgments about whether they understood the gesture targets, and if they did, they had to make a judgment as to the meaning that each gesture conveyed and in what situation each gesture may occur. The responses were written on an answer sheet. The experiment took thirty minutes.

Data analysis

If all twenty-two of the participants had provided responses for all eight of the experimental targets, there would have been 176 responses on the interpretation of the targets, paired with another 176 responses on the subject matter in talk. However, two participants did not write down the subject matter for the occurrence of two targets, and one participant did not provide a clear interpretation for a gesture; thus, six responses were eliminated. The final analysis included a total of 173 paired responses.

The first finding is that all of the gestures were considered as meaningful manual actions. In other words, the possibility that gestures are incomprehensible without speech should be rejected. Then, the responses to the first question about the meaning of the gesture in each clip were classified into different types of gestural meaning (hereinafter 'gestural-meaning type'), according to the kind

of event each response was associated with. If there was more than one response for each type of gestural meaning, all of the responses concerning the subject of the talk in each type were further grouped into different types of subject matter (hereinafter 'subject-matter type').

The median value for all of the gestural-meaning types is eleven, suggesting that the interpretations of the meaning of a spontaneous gesture can be numerous when speech is not available.

Results

In order to establish the reliability of the classification of the gestural-meaning types and the reliability of the classification of the subject-matter types, four coders independently judged all of the data that had been identified and analyzed by the original coder. The average rate of agreement between the original coder and the other coders for the classification of the gestural-meaning types was 97% for Target 1, 95% for Target 2, 98% for Target 3, 90% for Target 4, 96% for Target 5, 91% for Target 6, 91% for Target 7, and 92% for Target 8. The average rate of agreement between the original coder and the other coders for the classification of the subject-matter types was 92% for Target 1, 94% for Target 2, 94% for Target 3, 94% for Target 4, 92% for Target 5, 92% for Target 6, 97% for Target 7, and 95% for Target 8.

The gestural meanings were further classified into two kinds. The first kind, named as 'conceptual-content', corresponds to Kendon's (1995) category of *substantive gesturing,* i.e., that which 'contributes to various aspects of the content of the utterance of which it is a part' (ibid, p. 247). The second kind, named as 'non-conceptual-content', does not relate to the expression of conceptual knowledge, but has to do with facilitation of recall, facilitation of thought, or attention-getting. The proportions of the conceptual-content to the non-conceptual-content show evidently that a substantial majority of interpretations express conceptual knowledge (88%, 75 out of the total 85).

Then, among the conceptual-content responses, are the various different interpretations of a particular type of gestural meaning associated with different subject matters in talk? The gestural-meaning types which included more than one response, a total of twenty-nine, were singled out for tabulation. Except for the only case in which two gestural-meaning responses were associated with the same subject matter, the same type of conceptual content is usually associated with various subject matters.

Discussion

The question addressed in the study was whether gestures are comprehensible without speech. The results show that they were understood as meaningful gestures. The same gesture could carry different types of meaning, most of which were concerned with conceptual knowledge. Moreover, the same type of meaning could be associated with different subject matters in talk. This section will discuss the implications of the findings for speech-gesture integration and gestural-action representations.

As acknowledged in Section 1, there is considerable evidence in support of the integration of the two modalities in language production and comprehension. However, the ERP evidence in Holle and Gunter (2007: 1189) indicated that "the integration of gesture and speech in comprehension is not a purely automatic process but is modulated by…the proportion of meaningful and meaningless hand movements." Kelly et al.'s (2007) ERP experiments also demonstrated that the integration can be subject to neurocognitive control under the influence of pragmatic knowledge about the intentional relationship between gesture and speech. In another study using levels-of-incongruence paradigm, Kelly et al. (2010: 266) showed that "gesture and speech may be semantically integrated in a graded fashion." In the current study, when people viewed dynamic manual actions, the processing of gesture could be carried out under the circumstances that speech was not available – a common communicative situation in which speech encounters various kinds of communication noise in real face-to-face interactions. Altogether, these converging results suggest that speech-gesture integration is not entirely obligatory.

The fact that representational gestures without language were understood can be accounted for with respect to 'intentional stance' (Dennett 1987) and the recent findings in motor cognition. The relationship between intention and the use of gestures has been attested in many studies, in that "not only do speakers intentionally produce gestures in order to clarify speech, but interlocutors use gesture to clarify the intentions that underlie that speech" (Kelly et al. 2007: 224). In other words, intentions can be disclosed by gesture. Participants' responses in the current study of the comprehension of gesture reveal participants' common belief that the gesturers in the videos during face-to-face communication are rational and that their gestural behaviors are intentional actions. Under the circumstances that speech was not available, the hand configurations were still considered to be meaningful and communicative. During comprehension, figuring out what the gesturers intend to convey is the participants' personal predictions about what the gesturers will do in a situation. Dennett's idea of prediction is similar to 'action anticipation' in motor cognition, in that "shared representations form the basis of our ability to predict the outcome of our own and others' actions" (Sommerville and Decety 2006: 184).

Motor cognition studies "the way actions are thought, planned, intended, organized, perceived, understood, learned, imitated, attributed, or in a word, the way they are represented" (Jeannerod 2006: v). Gesturing is overt motor behavior; observing the dynamic gestures that occur in daily conversations leads to understanding, based on the motor resonance mechanism for simulation of an action and understanding of that action during action observation. The claim that the human mirror neuron system activates motor resonance is supported by considerable evidence from

behavioral, neurophsysiologic, and neuroimaging studies (Flanagan and Johansson 2003; Fischer 2005; Falck-Ytter et al. 2006; Uregesi et al 2006; Zwaan and Taylor 2006; Fischer and Zwaan 2008). Motor resonance enables a person to "match observed actions against one's own action repertoire to discover goals or intentions" (Fischer and Zwaan 2008: 831) in simulating actions for others. Representational gestures are not necessarily goal-directed; they mainly convey information along with speech, as illustrated in Examples (1) and (2). Nonetheless, what the participants did at the time that they observed the gestures in the experiment can be well explained with regard to motor resonance: The viewers of the gestures engaged in mental simulation "by a direct mapping of the visual representation of the observed action into [the viewers' own] motor representation of the same action" (Sommerville and Decety 2006: 184). By matching each gesture against the viewers' own repertoire of gesture based on the similarity between the manual action of the gesturer and the actions of the participants in the past, participants presented their own predictions about what the interlocutor in the natural communicative scene had made certain gestures for.

What participants expected represents the part in the viewers' own repertoire being activated during comprehension, because "[n]ot all of the content…becomes active at once. Instead, only a small subset becomes active to represent the category in a given situation" (Barsalou 2009: 239). From the responses, the activated content of the gestural-action representations is mostly concerned with substantive knowledge about concrete concepts such as writing a music score, and abstract concepts like showing motivations or emotions. Since the simulation of action rests upon individuals' knowledge and experience, the reading of the knowledge that was intended to be conveyed in a particular gesture could be inconsistent among the viewers. The finding aligns with the results in motor cognition that "actions may be differently perceived, based on the individuals' motor capabilities and experience" (Sommerville and Decety 2006: 184). Despite the inconsistencies in recognizing the conceptual content, the comprehension of gesture is unanimously associated with a situation of use. A situation of use consists of people's bodily and perceptual experiences from social interaction in recurrent socio-cultural activities or personal incidences. For instance, as shown in Table 2, the meaning of the movement of the right hand back and forth from left to right has to do with the participants' experiences of common daily activities such as writing and seasoning food, or of occasional activities such as making spatial arrangements and doing a simple routine task. Furthermore, the same type of responses (i.e., the same gestural-meaning type) can be associated with different situations of use. For instance, the writing experiences shown in Table 3 could come from the practices of documentation, taking notes, or signing a contract in real-life situations. In sum, the way representational gestures were understood in this study reveals the activated content of the gestural-action representations which consists of conceptual knowledge associated with a situation of use. The finding provides further evidence for situated representation in memory and conceptualization (Barsalou 2008; the reviews in Barsalou 2009), supporting the claim that "a target stimulus induces participants to imagine a background situation that is meaningfully related to the stimulus" (Yeh and Barsalou 2006: 358).

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Conceptual Metaphors and Gesture

隱喻概念與手勢

1. Introduction

In Lakoff and Johnson's (1980, 1999) theory of metaphor, "[c]onceptual metaphor is a natural part of human thought…[and] which metaphors we have and what they mean depend on the nature of our bodies, our interactions in the physical environment, and our social and cultural practices" (Lakoff and Johnson 1980: 247). Such embodied view of conceptual metaphors has been supported by a large amount of evidence from linguistic expressions in different languages. Despite the fact that metaphors in language are ubiquitous, Murphy (1996, 1997) and Glucksberg (2001) remain skeptical about the psychological reality of conceptual metaphors. They argue that using linguistic metaphors does not necessarily mean people do think metaphorically. Conventional metaphors in particular may have already been lexicalized without requiring the use of cross-domain cognitive mappings when people use them. Different sources of evidence were then proposed to refute the criticisms of circularity and lexicalization, among which evidence from psychological and neurobiological research was found to show that people do use sensorimotor experiences to understand metaphorical language and abstract concepts (Gibbs 2006, 2008). That linguistic metaphors shape thoughts can also be substantiated by Boroditsky's (2000, 2001) priming experiments which found that since Mandarin speakers talk about time in terms of a vertical spatial orientation and English speakers do so in terms of a horizontal spatial orientation, they also think differently about time. Not only did Mandarin speakers perform faster after vertical spatial primes than after horizontal spatial primes, but English speakers' performance was similar to that of Mandarin subjects after English subjects had been trained to use vertical metaphors. To the English subjects, the novel vertical metaphors influenced their conventional thought. Nonetheless, whether this new way of thinking about time will become the subjects' habitual conceptualization rests upon whether people repeatedly think about time vertically. In neuroscience, connections between the relevant sensorimotor areas of the brain and abstract conceptualization were also observed (Boroditsky 2000, 2001; Boroditsky and Ramscar 2002; Gallese and Lakoff 2005).

In gesture studies, "[e]xamination of real-time gestural production…is particularly useful in cases where the data are ethnographic rather than experimental; gesture is always there, and visibly present in the videotaped data" (Núñez and Sweetser 2006: 3). The specific manifestation of a metaphor in the use of the hands thus provides

independent visible evidence of metaphorical thinking, and supports the embodied nature of this pervasive cognitive phenomenon in communication (Cienki 1998; Cienki and Müller 2008; Gibbs 2008). Forceville (2009), on the other hand, investigates non-verbal metaphors in various modes of communication, such as pictures, music, sounds, and gestures. The present study rather focuses on metaphors as conveyed by hands and arms. Metaphoric gestures have been classified as 'ideographis' (Efron 1941/1972), 'ideographs' (Ekman and Friesen 1969, Rimé and Schiaratura 1991), a type of 'characterizing gestures' (Kendon 1989) or 'substantive gesturing' (Kendon 1995), a type of 'ideational gestures' (Hadar, Wenkert-Olenik, Krauss, and Soroker 1998), or 'metaphorics' (McNeill 1992). The hold-an-object gesture in Example (1) also appeared at the metanarrative level in McNeill's (1992: 14) narrative data, in that the speaker metaphorically presented the abstract cartoon genre in form of a bounded object while uttering 'It was a Sylvester and Tweety cartoon'. Cienki (1998) investigated American college students' metaphoric gestures for honesty and dishonesty. Núñez and Sweetser (2006) examined how Aymara speakers gesture the TIME-IS-SPACE metaphor. More studies can be seen in *Metaphor and Gesture* (2008), examining the gestural representations of metaphorical concepts in English narratives (McNeill 2008), conversation- interviews (Cienki 2008; Müller 2008), French television interviews (Calbris 2008; Montredon et al. 2008), English class instructions in elementary schools (Williams 2008), English lectures in college (Mittelberg 2008; Núñez 2008), and in an experiment (Parrill 2008).

The aim of this three-year project was to investigate the production and comprehension of the linguistic-imagistic representations of conceptual metaphors in both conversational and narrative discourse. The study employed the quantitative-qualitative approach to the analysis of a corpus of data. Since the study rest upon a spoken corpus of Mandarin conversations and oral narratives with gestural analysis, across the three years, new data were collected and transcribed, while old data were checked, revised and confirmed by different analysts. The findings are reported in Section 2. Concerning the examination of conceptual metaphors in language and gesture, we identified and analyzed the metaphoric gestures in the data with respect to (1) categorization of linguistic metaphors, (2) categorization of metaphoric gestures, (3) cross-domain cognitive mapping, (4) embodiment of metaphoric gestures, (5) dynamism of metaphoric gestures, (6) synchronization of conceptual metaphors in language and gesture, and (7) information state. Findings can be found in Section3. Finally, two psycholinguistic experiments were conducted to investigate the roles of language and gesture during language comprehension and metaphor comprehension. The findings are reported in

Section 4.

2. Collection and transcription of spoken and gestural data

Old data were checked, revised and confirmed by different analysts. New data were collected, transcribed and checked. The details of the new data are shown below:

Excerpt 1
Length of the transcription: 21 minutes
Participants: 2 female speakers
Recording date: 2012/03/23
Place: dorm room
Content: decayed teeth; contact lens; snacks; playing basketball; motorcycles; night scenes; friends

Excerpt 2
Length of the transcription: 20 minutes
Participants: 2 female speakers
Recording date: 2012/03/27
Place: space outside the classroom
Content: beehive; teacher's personality; Freud's growth theory; a friend's boyfriend; a handsome man who plays volleyball; personalities of those girls who play volleyball; volleyball court

Excerpt 3
Length of the transcription: 20 minutes
Participants: 1 female speaker and 1 male speaker
Recording date: 2012/04/04
Place: room
Content: blog; content of dreams; haircut; driving; Japanese food; rent a place for graduate study; colleague's new house; consecutive holidays; TV programs; fake eyelashes; Italian food

Excerpt 4
Length of the transcription: 17minutes
Participants: 2 male speakers
Recording date: 2012/04/07
Place: dining room

Content: a friend's recent situation; another friend's marriage; melancholia of a friend's wife; another person's attitudes towards life and work

Excerpt 5
Length of the transcription: 20 minutes
Participants: 2 female speakers
Recording date: 2012/04/09
Place: space outside the classroom
Content: inventions and patents; experimental reports; speaking volume; deadline for the seasonal reports; effect of internet on the work; job interviews and advisors; PhD oral defense

The data used for the present study were from The Corpus of Spoken Mandarin, a sub-corpus of The NCCU Corpus of Spoken Chinese. It consists of two types of data, namely daily face-to-face conversations and oral narratives. There are twenty-seven conversational excerpts, totaling 580 minutes of talk. As to the storytelling data, twenty-two narratives were collected in 2002. The elicited cartoon narrations ranged from about two to ten minutes in length, totaling about 1.5 hours.

3. Linguistic metaphors in gesture

An instance of linguistic metaphors in gesture can be found in Example (1). The conversational topic is tea processing, and M1 is saying that the procedure is important. The abstract idea of *guocheng* 'procedure' (Line 3) in the clausal utterance is conceptualized as a nominal entity; it is also depicted as an object by use of the hands: M1 first has the left leg placed across the right leg. After uttering the quantifier *henduo* 'a lot' (Line 1), just prior to the clause in which he will utter *guocheng*, he moves his right hand away from his left ankle to chest level. The left hand follows after the production of the copula *shi* (Line 3), rising to chest level from the thigh. During the 0.5-second pause between the copular *shi* and *guocheng*, both hands are held apart with the palms facing one another and the fingers are slightly curled, as if holding onto an object. This gesture with noticeable and discernable configuration iconically plays out the object concept in the source domain; what it represents is the tea-processing procedure in the target domain. Moreover, the whole manual configuration reveals people's understanding of a non-physical event in terms of an object with boundaries. It is a gestural instantiation of the Object Schema, in that "[w]e experience ourselves as entities, separate from the rest of the world…. And when things have no distinct boundaries, we often project boundaries upon them—conceptualizing them as entities" (Lakoff and Johnson 1981: 313).

(1) 1 M1: … danshi wo shuo zhende.. wo cha.. bushi dongde henduo
but 1SG tell real 1SG tea NEG understand a lot

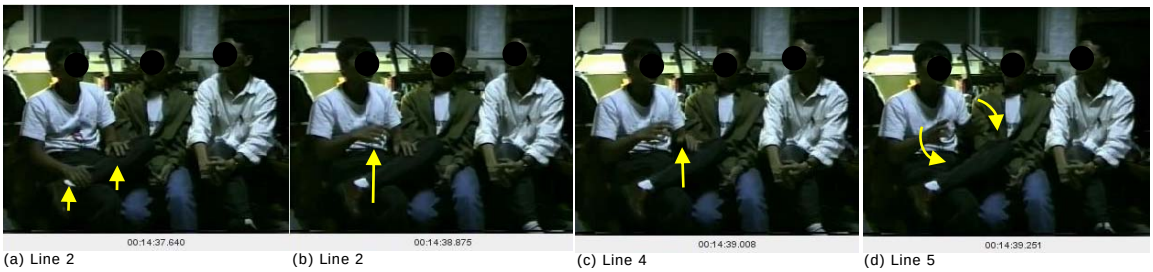
2 after *henduo*, right hand rises from left ankle to chest level ((a) to (b) in Figure 1)

3 …wo zui zhuyao shi...(0.5) **guocheng** la
1SG most important COP procedure PRT

4 *guocheng* 'procedure': after *shi*, left hand left hand starts rising from thigh to chest level ((c) in Figure 1)

5 during the 0.5-second pause, both hands are held apart with palms facing one another ((d) in Figure 1)

M1: 'But to tell the truth, I don't really know a lot about tea. I…the most important thing is the procedure.'



(a) Line 2 (b) Line 2 (c) Line 4 (d) Line 5

Figure 1. Gestural depiction of the tea-processing procedure

The gestural metaphors in the conversational excerpts were identified and analyzed with respect to 'information state' and 'meaning'. See the results below:

source	given/new	lexical constituents	meaning
M016-92	new	朋友類型	雙手掌心由下往上攤，再面下的空間比喻為朋友的類型
M016-143	given	遠	以左往右平行移動一距離的空間比喻為遠
M016-208	given	沒有	以五指聚合的空間表示沒有
M016-408	new	大家	以五指往下揮動的空間比喻為群體
M016-408	new	之前	五指向下畫圓的空間比喻為時間-以前
M016-570	new	暗示	以五指往下擺動的空間比喻為暗示
M016-586	new	(血型)相溶	以右手從左到右往下揮擺的空間比喻為相互溶合
M016-592	new	全部(的人)	以右手從左下揮動到右上的空間比喻為群體(全部的人)
M016-789	new	加權	以右手握拳往下點一下的空間比喻為加(家權)
M016-789	new	(分數)差	以右手上下揮動的空間比喻為相差
M018-85	new	(時間)落差	時間落差比喻為空間落差

M018-115	given	到後來	結果比喻為轉動
M018-141	new	兩個就講好	溝通比喻為東西傳遞
M018-237	given	換(衣服)	換(衣服)比喻為翻轉
M018-354	new	這些(遊戲)	遊戲比喻為物質(手持的物體)
M018-410	new	旅程	旅程比喻為圈圈
M018-186	given	以食指代表印章	
M018-229	given	以臉代表外貌	
M018-233	given	以臉代表外貌	
M019-1	new	不知道	以空間(左手手掌張開，掌心向上)所形成的空間比喻為事件(不知道)
M019-13	new	過年	以空間(雙手手掌張開，掌心相對，左右伸縮數次)所形成的空間比喻為時間(過年)
M019-35	new	適合結婚的人	以空間(右手手指微彎，拳心向上)所形成的空間比喻為群體(適合結婚的人)
M019-39	new	目前	以空間(左手手掌攤開，掌心向前)所形成的空間比喻為時間(目前)
M019-42	given	結婚	以空間(右手手掌攤開，手心朝上，瞬間手指彎曲握拳)所形成的空間比喻為事件(結婚)
M019-43	given	目前	以空間(左手手掌攤開，掌心向前)所形成的空間比喻為時間(目前)
M019-44	new	懶惰的程度	以空間(雙手握拳，向肘內緊縮)所形成的空間比喻為程度(懶惰的程度)
M019-52	new	念博士	以空間(雙手攤開向上，向肘外攤開)所形成的空間比喻為事件(念博士)
M019-54	new	法律	以空間(右手手指聚攏，如拿一物，手指稍微旋轉半圈)所形成的空間比喻為法律
M019-57	given	你這樣子(指沒有律師執照)	以空間(右手四指在上，拇指在下，如拿一物)所形成的空間比喻為沒有律師執照的身分
M019-60	new	考上律師	以空間(右手手指聚攏，如拿一物，掌心朝上)所形成的空間比喻為事件(考上律師)
M019-60	new	當法助(的時間)	以空間(雙手手掌張開相對)所形成的空間比喻為時間(當法助的時間)
M019-60	given	工作(的時間)	以空間(右手張開，掌心微微向上，從左至右方移動)所形成的空間比喻為時間(工作的時間)
M019-60	given	之後	以空間(右手張開微微向中間聚攏，掌心向上，向右方甩動一下)所形成的空間比喻為時間(工作之後)
M019-66	new	做很久	以空間(左手張開向上，從右方至左方平行移動)所形成的

			空間比喻為時間(法助工作做很久)
M019-66	given	後來	以空間(左手張開向攤開向說話者，後向左方移動)所形成的空間比喻為時間(後來)
M019-66	new	(能力)超過	以空間(雙手張開向說話者，後同時以手腕向外轉動)所形成的空間比喻為能力超越
M019-90	new	之後	以空間(雙手張開向說話者，後同時以手腕向外轉動)所形成的空間比喻為時間(吃早餐之後)
M019-92	new	錢不多	以空間(右手手指微彎，掌心朝上)所形成的空間比喻為薪水數量(錢不多)
M019-107	new	催他結婚	以空間(雙手攤開，手掌向上，雙手從中間再各自向外移動)所形成的空間比喻為事件(催他結婚)
M019-119	new	掰(考試的答案)	以空間(雙手攤開，手掌向上)所形成的空間比喻為事件(掰答案)
M019-129	new	考上研究所的那一年	以空間(雙手攤開，手掌向上，雙手從中間再各自向外移動)所形成的空間比喻為時間(考上研究所的那一年)
M019-129	new	弄推甄	以空間(雙手攤開，手掌向上，雙手從中間再各自向外移動)所形成的空間比喻為事件(弄推甄)
M019-129	new	弄很多(推甄的內容)	以空間的大範圍(右手攤開，手掌向左，右手從左至右至右到左)所形成的空間比喻為數量(推甄的內容)
M019-135	new	研究所考試在前	以空間(雙手攤開，手掌相貼，置於說話者腿上)所形成的空間比喻為考試的時間點
M019-139	new	畢業後一年	以空間(雙手攤開，掌心向內，由內向外轉動)所形成的空間比喻為時間(畢業後一年)
M019-171	new	在一起(交往)	以空間相疊(右手攤開向上，左手手指碰觸右手掌心)所形成的空間比喻為關係(交往在一起)
M019-187	given	上去徵友	以空間(雙手手掌攤開，掌心朝上)所形成的空間比喻為事件(上去徵友)
M019-196	new	吃飯	以空間(雙手手掌攤開相疊，掌心朝內)所形成的空間比喻為事件(吃飯)
M019-222	given	吃飯的時候	以空間(右手手指微彎，掌心朝上)所形成的空間比喻為時間(吃飯的時候)
M019-224	new	他女朋友(的事情)	以空間(右手手指微彎，掌心朝上)所形成的空間比喻為事情
M019-227	new	秘密	以空間(右手手指攤開，掌心朝上，拇指與食指相扣)所形成的空間比喻為秘密

M019-228	new	之前	以空間(右手手掌攤開，掌心朝上，拇指與無名指小指相扣)所形成的空間比喻為時間
M019-229	given	那個(秘密)	以空間(右手手指攤開，掌心朝上，拇指與食指相扣)所形成的空間比喻為那個秘密
M019-268	new	下一屆	以空間(右手掌攤開朝下，拇指與食指相扣，由說話者胸前至右方拉開)所形成的空間比喻為下一屆
M019-270	new	那一群	以空間(右手掌攤開朝下，畫圓一圈)所形成的空間比喻為群體
M019-270	new	化妝	以臉部的範圍(雙手張開向臉部，從中間雙手各自向外移動)所形成的空間比喻為化妝的範圍
M019-279	new	出門	以空間(右手指微彎，掌心向上)所形成的空間比喻為事件(出門)
M019-285	new	穿個簡單的牛仔褲 T-shirt	以空間(右手指微彎，掌心向上)所形成的空間比喻為事件(穿個簡單的牛仔褲 T-shirt)
M019-287	new	散發出來的感覺	以空間(右手指微彎，掌心向上)所形成的空間比喻為散發出來的感覺
M019-288	new	化妝跟打扮(會變成熟)	以空間轉動(右手掌攤開，掌心朝左，轉動數圈)比喻為狀態改變(化妝後的改變)
M019-294	new	很多人穿這樣短裙加高跟鞋	以空間(雙手手掌張開相對)所形成的空間比喻為群體(穿短裙高跟鞋的人)
M019-297	given	那個紅色	以空間(右手指微彎，掌心向上)所形成的空間比喻為種類(那個紅色)
M019-305	new	那個顏色	以空間(右手指張開聚攏，掌心向左)所形成的空間比喻為種類(那個顏色)
M019-307	given	紅色漆皮高跟鞋	以空間(右手指微彎，掌心向上)所形成的空間比喻為種類(紅色漆皮高跟鞋)
M019-313-315	new	黃色、藍色	以空間(右手指微彎，掌心向上)所形成的空間比喻為種類(黃色、藍色)
M019-317	new	粉綠色	以空間(右手指微彎，掌心向上)所形成的空間比喻為種類(粉綠色)
M019-331	new	一開始	以空間(右手指微彎，掌心向上)所形成的空間比喻為時間(一開始)
M019-333	given	買了就化	以空間(左手指微彎，掌心向上，從左至右移動)所形成的空間比喻為事件(買了就化)
M019-336	new	地政系商院的女生	以空間(雙手手掌攤開相對)所形成的空間比喻為群體(地政系商院的女生)
M019-336	given	化妝	以空間(右手手掌攤開向左，手指微彎，輕輕向右甩動一

			下)所形成的空間比喻為事件(化妝)
M019-362	given	現在	以眼前空間(雙手攤開手掌向內，指向說話者前方的空間)比喻為眼前的時間(現在)
M019-362	given	之前	以空間前(雙手攤開手掌向內，指向說話者前方的空間，手指後向前撥一下)比喻為時間前(之前)
M019-363	new	中間(交男友的順序)	以空間(右手手指彎曲，拇指及食指圈起一個圓圈)比喻為順序(交男友的順序)
M019-367	new	剛剛	以空間(右手手指彎曲，掌心向上，從右至左輕輕移動一下)比喻為時間(剛剛)
M019-369	given	第一個	以空間(右手指微彎，掌心向上)所形成的空間比喻為第一個聊到的對象
M019-378	new	內在	以空間(雙手攤開，掌心向內，畫圓一圈)所形成的空間比喻為內在
M019-378	new	交流	以空間交疊(雙手攤開，掌心向內，相疊又遠離來回數次)所形成的空間比喻為內心交流
M019-378	new	委屈的神情	以空間(雙手攤開，掌心向內，由上至下移動)所形成的空間比喻為委屈的神情
M019-408	new	暑假	以空間點(右手手掌攤開，左手食指觸碰在右手手掌上)所形成的空間比喻為時間點(暑假)
M019-426	given	認識	以空間(雙手手掌張開，掌心相對)所形成的空間比喻為事件(認識)
M019-428	given	漸漸發生	以空間(雙手手掌張開向下，雙手手指微微顫動，雙手並由左而右移動)所形成的空間比喻為事件(認識)
M019-438	given	大家都知道	以空間(雙手手掌張開向下，雙手各自由中間向外移動)所形成的空間比喻為事件傳播的範圍
M021-225	new	一天	時間比喻為空間(右手劃出一段空間)
M021-275	new	這樣(主動表示聽得懂中文)	形為比喻為物質(雙手手心相對圍出的空間)
M021-279	given	現在	時間比喻為空間(右手手心向前圍出的空間)
M022-151	new	為難	以手掌往下拍動的空間比喻為難的狀況
M022-214	new	(生活水準)降低	以手掌往下拍動的空間比喻為(生活水準)降低
M022-319	new	鏡面曲折率	以食指與拇指指尖互扣比出一小圓空間比喻為鏡片曲折率
M022-325	new	沒辦法	以雙手掌心向上攤平的空間比喻為沒辦法
M023-3	new	大概的時間	以手如輕抓一物的空間比喻為"大概的時間點"
M023-291	new	下一個假期	以手掌面上的空間比喻為下一個假期

M024-77	new	很早	以空間(右手拇指與食指伸出，向外指了一下)比喻為時間點
M024-118	given	一群(那種)蜜蜂	以空間(左手手掌攤開朝向左方)比喻為蜜蜂群體
M024-123	given	幾隻(蜜蜂)	以空間(雙手手指微彎，掌心向內，向內抓動數次)比喻為蜜蜂群體
M024-172	given	一隊(消防車)	以空間(雙手手指微彎，雙手同時向內揮動一次)比喻為群體(一隊消防車)
M024-190	new	猜	以空間(左手手掌攤開，掌心朝上)比喻為猜想
M024-222	given	那時候	以空間(右手拇指向外比了一下)比喻為時間
M024-222	new	態度(還 OK 啊)	以空間(左手手掌攤開，掌心向上)比喻為態度
M024-235	new	管教	以空間(右手手掌攤開，掌心向上，由右方向左方畫過一條曲線)比喻為事件(管教)
M024-237	new	人格	以空間(右手手掌攤開向下，由右而左揮動數下的空間)比喻為人格
M024-237	new	正相關	以空間(右手手掌攤開向左，由右向左平行移動數次)比喻為相關性
M024-277	new	陰影	以空間(右手手指向內彎曲，手掌向內輕拍數下的空間距離)比喻為心靈上的陰影
M024-301	new	人生	空間(右手手掌張開向下，從右下至左上步步移動的空間)比喻為時間(人生各階段)
M024-301	new	過程	以空間(右手手指微彎，掌心向上的空間)比喻為時間
M024-322	given	事件(出軌)	以空間(左手手指微彎，掌心向上所形成的空間)比喻為事件(出軌)
M024-328	given	覺得	以空間(左手手指微握拳，拳心向內，由內向外移動)比喻為事件(認為)
M024-357	new	面試	以空間(右手拇指及食指微微伸出，向內畫一圈)比喻為事件(面試)
M024-357	new	下午	以空間下方(右手拇指及食指微微伸出，向下移動)比喻為時間(下午)
M024-363	new	木訥的	以空間(右手手掌張開，掌心向內，向內揮動數次所形成的空間)比喻為個性木訥
M024-367	new	很誠懇的	以空間(雙手手掌張開，掌心向上，由上而下移動)比喻為態度誠懇
M024-371	new	心情狀態	以空間(右手手指聚集於一點，掌心向上，瞬間將手指攤開)比喻為心情的狀態
M024-383	new	怦然心動	以空間(雙手手指微彎，掌心向內，雙手手指各自畫圈所形成的空間)比喻為內心的激動

M024-401	new	這麼久	以空間(右手手指微彎，掌心向內，食指伸出畫一圓)比喻為時間
M024-401	new	互相	以空間(右手手指微彎，掌心向左，由右而左由左而右移動數次)比喻為互相的關係
M024-415	new	傻傻的	以空間(右手手掌攤開，掌心向內，畫圈數次形成的空間)比喻為個性(傻傻的)
M024-417	new	很真	以空間(右手手掌攤開，掌心向內，由內而外畫圈一次形成的空間)比喻為個性(很真)
M024-421	new	想法	以空間(右手手指彎曲，掌心向內，由外向內畫圓數次的空間)比喻為思想
M024-429	new	心花	以空間(雙手手掌攤開向上，雙手畫圈數次所形成的空間)比喻為心情
M024-429	new	(心花)開	以空間開(雙手攤開向上，雙手從胸前向外向下各自延伸所形成的空間)比喻為心情開闊
M024-431	new	也有過一樣的動作	以空間(右手手指攤開，掌心朝下，畫圈數次)比喻為事件(有過一樣的動作)
M024-431	new	以前	以空間(右手手指微彎，掌心向左，由右而左移動一次，再由右而左左而右來回移動一次)比喻為時間
M024-437	new	事情	以空間(右手手掌攤開，掌心向左，由右而左畫圈一次)比喻為事情
M024-441	new	一起打球的人	以空間(左手手指微彎，掌心由內向外畫圈一次)比喻為群體(一起打球的人)
M024-441	new	好朋友	以空間(雙手手指微彎，掌心相對，由內向外拉出一個空間)比喻為關係(好朋友)
M024-449	new	個性	以空間(右手手指微彎，掌心向上，手指向內揮動數下所形成的空間)比喻為個性
M024-453	new	比率	以空間(右手手掌張開向下，由右向左移動數次所形成的空間)比喻為比率
M024-475	new	所有(運動的人)	以空間(右手手掌張開向下，由右向左畫圈一次)比喻為群體(所有運動的人)
M024-475	new	運動很好的人	以空間(右手微微握拳，由左下至右上移動)比喻為群體(運動好的人)
M024-483	new	大剌剌	以空間(左手手掌攤開，掌心向內，由內向外移動)比喻為個性(大剌剌)
M024-495	given	所有人	以空間(雙手微握拳，掌心向上，由外而內畫圈一次)比喻為群體(所有人)
M024-539	given	真誠的	以空間(右手張開，掌心向內，由下而上移動)比喻為態度

			(真誠)
M024-539	given	誠懇的	以空間(右手握拳，拳心向上)比喻為態度(誠懇)
M024-545	new	厲害	以空間(右手手掌張開，掌心向內畫圈一次)比喻為特性(厲害)
M024-547	given	帥	以空間(右手食指伸出，指向前方的空間)比喻為特性(帥)
M024-547	new	話不要太多	以空間(右手食指伸出，指向前方的空間)比喻為特性(話不要太多)
M024-579	new	太聒噪	以空間(右手食指伸出，由內而外畫圈一次)比喻為特性(太聒噪)
M024-579	given	同(一隊)	以空間(右手食指伸出，由內而外來回移動數次)比喻為事件(同一隊)
M024-591	new	花錢	以空間(右手手指微微握拳，食指伸出向前方比了一下)比喻為事件(花錢)
M024-599	new	全木質	以空間(右手手掌張開向下，由左向右平移)比喻為全體(全木質的地板)
M024-623	new	計次	以空間(右手食指伸出，向前方指了一下)比喻為事件(計次)
M024-623	given	小時	以空間(右手手掌張開，掌心朝下，以末三指揮動數次)比喻為時間
M024-627	given	這些人	以空間(右手手掌張開向下，由右向左畫圈一次)比喻為群體(這些打球的人)
M024-631	new	每個人	以空間(右手手掌張開，掌心向左，由右而左畫圈一次)比喻為群體(打球的每個人)
M024-631	given	一個晚上	以空間(右手手指微彎，掌心向下)比喻為時間
M024-633	new	下面那一隊	以空間下(左手手指微彎向上，右手手指微彎向下，右手向下點一下)比喻為下面那一隊
M024-637	new	輸	以空間(雙手手掌攤開朝上形成的空間)比喻為事件(輸)
M024-637	given	下(場)	以空間下(右手拇指與食指伸出，向下移動)比喻為下場
M024-19-21	new	外星人	以外星人的動作(右手食指伸出，與 F2 伸出的食指相觸)比喻為外星人
M024-31	new	泡酒	以泡酒的容器(雙手手掌攤開向上，手指輕觸呈容器狀)比喻為泡酒
M024-361	new	濃眉大眼	以臉的一部份下巴(右手拇指與食指指向下巴)比喻為相貌(濃眉大眼)
M025-65	new	出現	出現比喻為轉動(右手轉動)

M025-81	new	生病的狀態	狀態比喻為物質(右手手心向上成碗狀)
M025-93	given	這樣子(家暴的情況)	狀況比喻為物質(雙手手心向上成碗狀)
M025-131	new	自從(某個時間)	時間點比喻為空間點(右手在空中點一下)
M025-145	given	(生病的)狀態	狀態比喻為物質(右手手心向上微微成碗狀)
M025-161	new	辦法	辦法比喻為物質(雙手手心相對圍出的空間)
M025-177	new	那陣子	一段時間比喻為一段空間(右手在空中劃出圓形空間)
M025-183	new	不高興	情緒比喻為物質(雙手手心向上成托物的樣子)
M025-226	new	(賺錢的方法)東西	手段比喻為物質(左手手心向上成碗狀)
M025-231	new	(副總級)以上	職位在上比喻為空間在上(右手往上移)
M025-251	new	一個 poll	選舉比喻為物質(右手食指劃出圓形空間)
M025-251	given	一個普查	普查比喻為物質(右手劃出圓形空間)
M025-253	new	很糟	糟比喻為下(右手向下揮動)
M025-263	new	以後	時間比喻為空間(右手從身體中心一點往外側滑動)
M025-265	new	很積極	積極比喻為轉動(右手食指劃圓)
M025-271	given	東西(手段)	手段比喻為物質(雙手手心向上成托物的樣子)
M026-40	given	這個 (事情)	事情比喻為物質(左手手心向下圍出的空間)
M026-110	new	下一句	(下一句)出現比喻為轉動(右手手心向上翻動)
M026-315	new	(騎車的)時候	一段時間比喻為一段空間(雙手手心相對圍出的空間)
M026-328	given	還好	(山路陡峭程度)還好比喻為水平線(左手手心向下,水平滑動)
M026-337	given	這個禮拜一	時間點比喻為空間點(右手食指向下點)
M026-355	new	小時候	時間點比喻為空間點(右手在身體左側點了一下)
M026-358	new	長期	時間比喻為空間(雙手手心相對分別往外拉出的空間)
M026-360	new	這種(讚美)	讚美比喻為物質(右手手心向上成托物狀)
M026-396	new	(追他)之後	時間比喻為空間(左手從身體中心一點往外滑動)
M027-14	given	發明	以空間（左手手掌向下形成碗狀空間，手掌向下點一下）比喻為事件（發明）
M027-14	new	拿去	以空間（左手手掌向下形成碗狀空間，手掌向下點一下）比喻為事件（拿去做專利）
M027-16	new	上廁所的時候	以空間（雙手手掌張開互對，形成空間）比喻為時間（上廁所的時候）
M027-91	new	0.03(數值)	以空間(左手手掌張開向下，手指微彎，掌心向下點兩下）比喻為範圍（0.03 數據的範圍）

M027-93	new	跨不過去	以空間（左手食指伸出，從說話者的左下方至右上方畫過的空間）比喻為跨越
M027-147	new	溫和	以空間（左手微微握拳，拳頭向外轉動一圈）比喻為講話聲音的轉變
M027-196	given	這個禮拜	以空間（右手握拳，食指微微伸出，向前方空間點一下）比喻為時間（這個禮拜）
M027-245	new	多做一點事	以空間（右手手指彎曲，向掌心包覆所形成的空間）比喻為事情的數量
M027-245	given	多一點點事情	以空間（右手手指彎曲向下，手指向掌心包覆所形成的空間）比喻為事情的數量
M027-299	new	一屆一屆	以空間上下（右手手指伸出，掌心朝內，右手從上方點一下後向下方點一下）比喻為屆數的上下
M027-299	new	配上	以空間（左手手掌攤開向內，右手手掌攤開向內並從內到外環繞左手一圈）比喻為搭配
M027-313	new	報到	以空間（右手握拳，食指微微伸出，向前方點一下）比喻為事件(報到)
M027-321	new	認識	以空間（雙手手指伸開，掌心相對形成空間）比喻為事件(認識)
M027-340	new	老師的網頁	以空間（左手手掌瞬間張開，掌心向左）比喻為物件(老師的網頁)
M027-362	new	系上所有的老師	以空間（雙手手掌張開，並向內聚集）比喻為群體(系上所有的老師)
M027-364	new	都在	以空間（雙手手掌張開，並向內聚集）比喻為事件(聚集)
M027-364	new	用英文報告	以空間（雙手手掌張開向上，雙手各從內向外攤開）比喻為事件(用英文報告)
M027-364	new	要聽的人	以空間（雙手手掌張開向下，雙手以畫圈方式晃動）比喻為群體(要聽的那些人)
M027-364	given	系上所有的老師	以空間（雙手手掌張開相對，雙手向內移動）比喻為群體(所有系上的老師)
M027-372	given	用英文	以空間（右手食指伸出，畫圈一次的空間）比喻為事件(使用英文)
M027-378	new	所有	以空間（右手手掌向下，在桌面上方畫一圈）比喻為群體(所有的蛋糕)
M027-382	given	報告	以空間（左手微微握拳，掌心向右，從下而上移動）比喻為事件(報告)
M027-385	new	問問題	以空間（右手手指併攏，掌心向下，在桌面上由內向外點擊數下）比喻為事件(問問題)

M027-396	new	買水果	以空間（雙手掌心向內相疊，雙手手指向上形成圓弧狀）比喻為事件(買水果)
M027-402	new	問問題	以空間（左手拇指及食指微微伸出，指向前方空間）比喻為事件(問問題)
M027-454	new	另外兩個教授	以空間（左手張開掌心向右，由內向外伸出）比喻為群體(兩位教授)
M027-458	given	電(問問題)	以空間（左手拇指及食指伸出，指向前方）比喻為事件(問問題)

Below are the findings concerning linguistic metaphors that were depicted by gesture. Since the present study did not consider the multiple occurrences of a metaphor, our data yielded 110 instances of linguistic-gestural metaphors. In the narrative data, however, only 3 instances were found, because of the content of the video stimulus about real physical objects and activities. The video stimulus that was used to elicit narrative data was a seven-minute cartoon episode of the 'Mickey Mouse and Friends' series. In the episode, Mickey, Minnie, Pluto and a bull are holding a party at the beach, and eating and playing around. They then have a fight with an octopus, which they finally win. Owing to the rarity of linguistic metaphors in narrative discourse, the discussion of the linguistic-gestural representation of conceptual metaphors in this report was based on the conversational data.

Categorization of linguistic-gestural metaphors

Table 1 shows the frequency distribution of different types of metaphor being expressed in language and gesture. Six types of metaphors were found in conversational discourse: ENTITY metaphor, ORIENTATION metaphor, FICTIVE-MOTION metaphor, CONTAINER metaphor, CONDUIT metaphor, and complex metaphor. The entity metaphor conceptualizes a target domain in terms of discrete object or substances. The orientation metaphor is the metaphor in which the target domain is conceptualized in terms of spatial concepts, including spatial orientations, path, location, etc. The fictive-motion metaphor refers to the metaphor in which static things or abstract concepts are conceived in terms of dynamic motions. The container metaphor is the metaphor in which its target domain is conceived in terms of the containers with a bounded surface and in-out orientation. The conduit metaphor conceptualizes human communication as a conduit which can physically transfer our thoughts or feelings (Reddy 1979). Finally, the complex metaphor refers to the metaphor which has no direct and independent correlation to our sensory-motor experiences. However, we still need the knowledge of our bodily experience or socio-cultural practices to comprehend such metaphor. The statistics in Table 1 show that ENTITY metaphors comprise the majority (79 tokens,

71.8%), and ORIENTATION metaphors are the second most (24 tokens, 21.8%). The other four types of metaphors merely account for a small portion.

Table 1. Categorization of linguistic-gestural metaphors

Entity metaphor	79	71.8%
Orientation metaphor	24	21.8%
Fictive-motion metaphor	3	2.7%
Container metaphor	2	1.8%
Conduit metaphor	1	0.9%
Complex metaphor	1	0.9%
Total	110	100.0%

Cross-domain cognitive mapping and embodiment

To examine cross-domain cognitive mappings between the source domains and target domains in metaphor, the present study categorized the source-domain concepts with regard to image schemas (Johnson 1987; Cienki 1997; Clausner & Croft 1999; Santibáñez 2002). Table 2 indicates the different source domains of linguistic-gestural metaphors and their respective frequency distribution. Six kinds of sources were found: OBJECT, SPACE, FICTIVE-MOTION, ACTIVITY, CONTAINER, and PATH. OBJECT is the most frequent source (79 tokens, 71.8%), followed by SPACE (22 tokens, 20.0%). As to target domains, seven types of target-domain concepts, each including at least three instances in the data, were found: TIME, SPEECH CONTENT, SEQUENCE, DEGREE, STATE, PHYSICAL ACTIVITY, and MENTAL ACTIVITY. The other kinds with less than three instances were categorized as 'others'. Table 3 shows that TIME and SPEECH CONTENT were often expressed through linguistic-gestural metaphors.

Table 2. Source domains of linguistic-gestural metaphors

Object	79	71.8%
Space	22	20.0%
Fictive-motion	3	2.7%
Activity	2	1.8%
Container	2	1.8%
Path	2	1.8%
Total	110	100.0%

Table 3. Target domains of linguistic-gestural metaphors

Time	16	14.5%
Speech content	13	11.8%
Sequence	6	5.5%
Degree	4	3.6%
State	4	3.6%
Physical activity	3	2.7%
Mental activity	3	2.7%
Others	61	55.5%
Total	110	100.0%

Dynamism of metaphoric gestures

The visible occurrences of gestures in multimodal communication can bear out the dynamic aspect of embodied cognition. In the literature, "theories of situated action often adopt dynamic systems as their architecture. From this perspective, fixed representations do not exist in the brain" (Barsalou 2008: 621). The dynamic systems for simulations are mainly concerned with computational architectures. In the context of conversational interaction, the lack of fixed representations of the embodied-situated knowledge can also be manifested in gestures. In conversational discourse, the source concepts of TIME, SPEECH CONTENT, SEQUENCE, DEGREE, STATE, PHYSICAL ACTIVITY and MENTAL ACTIVITY were used to conceptualize many targets (see Table 4). On the other hand, the target concepts of TIME, MENTAL ACTIVITY, SPEECH CONTENT and SEQUENCE could be conceptualized by numerous source concepts (see Table 5).

Table 4. One source to many targets in conversational discourse

Source	Target			
object (79)	speech content (12)	time (7)	state (4)	data (3)
	knowledge (3)	language (3)	occupation (3)	work (3)
	activity (2)	chance (2)	choice (2)	color (2)
	mental activity (2)	method (2)	power (2)	quantity (2)
	ability (1)	advertisement (1)	agreement (1)	category (1)
	department (1)	doctor degree (1)	examination (1)	experience (1)
	expression (1)	feeling (1)	function (1)	growth (1)
	holiday (1)	information (1)	mind (1)	patent (1)
	pay (1)	price (1)	procedure (1)	secrete (1)
	sequence (1)	status (1)	system (1)	temperature (1)
	trick (1)			

space (22)	time (8)	sequence (5)	degree (4)	engagement (1)
	fulfillment (1)	living standard (1)	relationship (1)	status (1)
activity (2)	communication (1)	mental activity (1)		
fictive motion (3)	number (1)	speech content (1)	time (1)	
path (2)	career (1)	preparation (1)		
container (2)	land (1)	stock market (1)		

Table 5. Many sources to one target in conversational discourse

Source			Target
space (8)	object (7)	fictive motion (1)	time (16)
object (2)	activity (1)		mental activity (3)
object (12)	fictive motion (1)		speech content (13)
space (5)	object (1)		sequence (6)

Synchronization of conceptual metaphors in language and gesture

Regarding the temporal relationship between gestures and accompanying speech, the present study analyzes the stroke phases which are relevant to conveying information. The gestural strokes can be further sorted into three types: those synchronizing with the associated words (the *synchronizing gestures*), those coming before the associated words (the *preceding gestures*), and those coming after the associated words (the *following gestures*). Table 6 demonstrates that linguistic-gestural metaphors mostly involve synchronizing gestures (93 instances, 84.5%). Preceding gestures account for 12.7% (14 instances), and following gestures make up 2.7% (3 instances).

Table 6. Synchronization of metaphors in language and gesture

Preceding	14	12.7%
Synchronizing	93	84.5%
Following	3	2.7%
Total	110	100.0%

Information state

In this study, a two-way distinction of information status was used to characterize the information status of referents. First, a referent was analyzed as ‘new’, if it had never been brought up in the previous context within a conversational topic at the moment of speaking. Second, a referent was analyzed as ‘given’, if it had already been brought up at the moment of utterance. Table 7 shows the frequency distribution of new metaphors and given metaphors. In most cases, linguistic-gestural metaphors carry new information (75 tokens, 68.2%).

Table 7. Information state of linguistic-gestural metaphors

Given	35	31.8%
New	75	68.2%
Total	110	100.0%

In summary, based on the linguistic and gestural analyses, and statistics, the study provided the following findings which help understand the linguistic-gestural expression of conceptual metaphors in speech communication. It was found that ENTITY metaphors and ORIENTATION metaphors most frequently occur in daily conversation. The most common source-domain concept for ENTITY metaphors is OBJECT; those for ORIENTATION metaphors are SPACE and PATH. The study provided empirical data for one-source-to-many- targets and many-sources-to-one-target correspondences. The linguistic-gestural representation of metaphors and the synchronization of speech and gesture bear out the Interface Hypothesis that "a gesture is shaped by the formulation possibilities of the language… and at the same time the gesture may encode the spatio-motoric information that is not expressed in the speech" (Kita and Özyürek 2003: 18).

4. Experimental studies of metaphor comprehension

Another focus of research was to conduct experiments to investigate how people comprehend metaphorical ideas as expressed in language and gesture. An experiment was done in the second year. It used real face-to-face communication materials as stimuli to investigate the comprehension of representational gestures when speech was not available. Twenty-two adults watched short, soundless video clips extracted from recordings of daily conversations, each including a spontaneous representational gesture. Participants were requested to judge whether and in what way the gestures made sense. Their responses showed that in the absence of speech, the idiosyncratic hand configurations were not incomprehensible, suggesting that speech-gesture integration was not entirely obligatory. The way representational gestures were understood in this study reveals the activated content of the gestural-action representations which consisted of conceptual knowledge associated with a situation of use. The experimental results were presented in The 34th Annual Meeting of The Cognitive Science Society (CogSci 2012), Sapporo, Japan, August 1 - 4, 2012.