

Translating Cognitive and Linguistic Metaphors in Popular Science: A Case Study of Scientific Discoveries

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Since the cognitive turn in metaphor studies in the late 1970s, metaphor has been seen as a cognitive phenomenon reflecting how we think, alongside its classic role as a powerful literary device. This ‘cognitive turn’ in metaphor studies makes it possible to investigate metaphor in two facets: the cognitive one and the linguistic one. In this tenet, the notion of metaphor features two intertwined parts: conceptual metaphors which resemble mental connections between different knowledge packets (e.g., LIFE IS A BOOK), and their linguistic manifestations known as metaphorical expressions or linguistic metaphors (e.g., They are starting a new chapter of their life). This opens a window for metaphor translation research, for it allows researchers to examine metaphor translation from the two complementary facets. Building on conceptual metaphor theory (Lakoff and Johnson 1980, 2003) and conceptual blending theory (Fauconnier and Turner 2002), our case study discusses the translation of cognitive and linguistic metaphors identified in source and target texts. Metaphorical expressions were handpicked from seven popular cosmological articles published in *Scientific American* between 2017 and 2018, and their official Chinese translations published in *Huanqiu kexue* (‘global science,’ Beijing) and *Kexueren* (‘science person,’ Taipei). The findings lend support to the joint application of two metaphor theories to descriptive translation studies, for it not only facilitates the analysis of translation examples but also enhances the feasibility of comparing metaphor translation research across languages pinned by metaphor parameters waiting to be explored.

Keywords: conceptual blending theory; conceptual metaphor theory; metaphor translation; popular science

1. Introduction

Scholarly reasoning on metaphor has sparked refreshing ideas in translation studies. Metaphor, in its own right, is regarded by Gideon Toury as the “ultimate test of any theory of translation” (1995, 81). Still, in the current landscape of translation studies, metaphor translation remains a niche area of interest, which mirrors the situation in metaphor studies.

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Though relatively small in quantity, metaphor translation research has achieved quality advancement, nourished by the introduction of cognitive metaphor theories (e.g., Mandelblit 1995; Al-Harrasi 2001; Deignan and Potter 2004; Schäffner 2004; Shuttleworth 2017).

In 1980, George Lakoff and Mark Johnson’s introduction to conceptual metaphor theory in *Metaphors We Live By*, illuminated by the experientialist approach to language studies rooted in Max Black’s pioneering works (e.g., “Metaphor” published in 1954 and *Models and Metaphors: Studies in Language and Philosophy* published in 1962), propagated a long-awaited intellectual awakening among metaphor scholars. Conceptual metaphor theory sees metaphor as a cognitive phenomenon, reflecting the way we think embedded in our bodily experience of the socio-physical world (Ritchie 2013, 209). In this tenet, the production and development of metaphors are subject to the linguistic formation and transformation of socio-physical experiences in different geo-cultural contexts. Peter Newmark observes that “it is possible that no metaphors are universal” (1981, 87) and draws scholarly attention to this phenomenon.

Metaphors used in the scientific discourse are no exceptions. The existing literature in metaphor translation research draws heavily on literary, religious, and political texts, leaving the vast realm of popular science largely underexplored. Because metaphors have an impact on “how we think and feel” (Semino 2021, 51), the questions of how they were used, how they are being used, or even how they would have been used require further investigation. This is particularly pertinent to popular science in the post-truth era, where the truth about the physical world is on one end and the massive audience involved as knowledge receivers is on the other.

To better understand how metaphor travels across languages, this paper makes an attempt to investigate metaphor translation in its linguistic and cognitive facets in light of two cognitive theories. Building on a case study, this paper presents the feasibility of conceptual metaphor theory and conceptual blending theory for translation analysis and seeks to voice the necessity of tailoring theories originated in other disciplines for translation research.

The rest of this paper is structured as follows: section 2 provides a skeletal overview of metaphor translation research before identifying the existing gaps, which helps to clarify the rationale behind this case study; section 3 presents the methodological issues of the case study, including data collection and analysis; sections 4 and 5 comprise findings and discussions, and section 6 concludes with key findings and research potentials.

2. Metaphor in Translation

In the late 1970s, the cognitive view of metaphor emerged (e.g., Ricœur 1978; Ortony 1979; Lakoff and Johnson 1980), opposing the previous tendency where metaphors were seen, and only seen, as “a literary or rhetorical device in the west” (Yeh 1982, 1). Cognitive linguists regard language as an important source for understanding the working mechanism of the brain. It is believed that metaphor reflects our bodily experience, and it is an essential part of human cognition. As David Ritchie (2013, 209) defines, metaphor is a cognitive phenomenon whereby we talk and think about something in terms of something else. As the literature shows below, this perception of metaphor has imposed considerable influence on metaphor translation research.

Before the current trend of adopting cognitive metaphor theories to study translation-related issues, Christina Schäffner (2004, 1253–1254) summarizes two key themes in metaphor translation research: the translatability of metaphors (e.g., Dagut 1976; van den Broeck 1981; Stienstra 1993) and the distillation of metaphor translation procedures (e.g., Newmark 1980, 1988; Toury 1995, 2012). Both themes are pertinent even to date—the earlier discussions on these issues have put up solid scaffolding for the ongoing conversation about metaphor translation. On the grounding that these discussions set, translation scholars are able to investigate metaphor translation from various perspectives with the help of cognitive metaphor theories. This introduction provides fresh air for advancing metaphor translation research in theoretical and methodological respects.

On the one hand, the most prominent theoretical discussion is on the cognitive approach to translation studies, which features three major threads. First, as one of the most influential works, Nili Mandelblit (1995, 486) coins the term ‘cognitive translation,’ indicating that translation is not only a linguistic shift but also a shift between different conceptual ontologies. In the same vein, this idea has been developed by translation scholars to revisit some of the classical topics in translation studies, such as ‘(cognitive) equivalence,’ as featured in Mohammad Q. Al-Zoubi, Mohammed N. Al-Ali, and Ali R. Al-Hasnawi (2007) and Pawel Sickinger (2017), among others.

Second, cognitive metaphor theories provide a theoretical basis for viewing translation products as a source for understanding translators’ mental activity when translating. For example, Gary Massey and Maureen Ehrensberger-Dow (2017) lend support to the feasibility

of combining product-oriented approach with process-oriented approach based on an experiment of metaphor translation. Recent studies have witnessed further development in this trend, viewing translation products (and by-products) as sources for understanding the cognitive efforts of translators during the translation process (e.g., Zhou 2021; Massey 2021).

Third, metaphor has been widely used as a metalanguage in translation studies (Guldin 2016, 2) and the perception of ‘translation’ can have a profound influence on the manifestation of translation theory and practice. In *Memes of Translation: The Spread of Ideas in Translation Theory*, Andrew Chesterman (1997) explores the cognitive power of metaphor and the potential impact that it can have on translation studies. More recently, in the article titled “What Happens If We Think That Translating Is a Wave?” Ubaldo Stecconi states that metaphors have an important cognitive function, because “they can help us adopt fresh viewpoints for our inquiries” (2010, 58). In the collective volume *Thinking through Translation with Metaphors* edited by James St. André (2010), scholars explore the connections between metaphor and translation, where metaphors are not regarded as “mere ornaments” but as “formative, generative ways of thinking about translations, translators and various aspects of the process of rendering the meaning of a text in another language,” as Anne Coldiron (2011, 278) reviews.

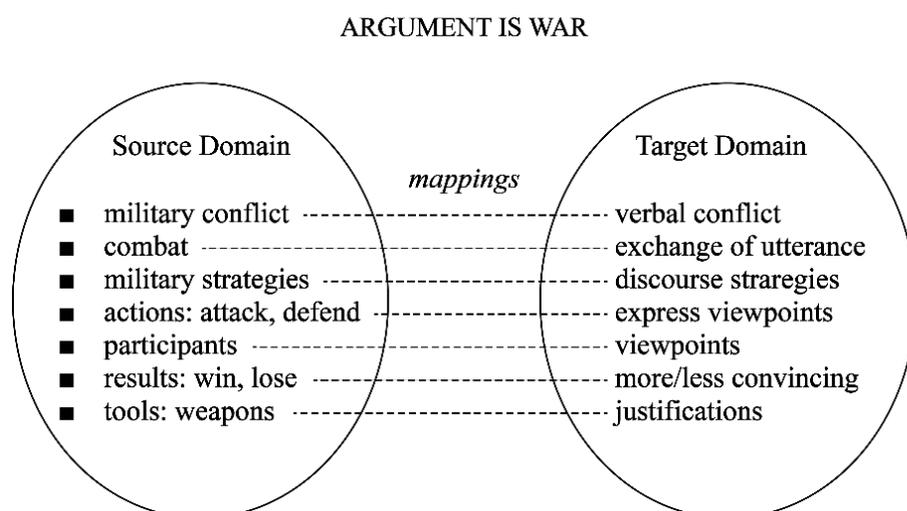
On the other hand, methodological development in metaphor translation research is more eclectic in nature, with complementary methods often crossing paths in practice. This line of research is indebted to two fundamental themes: the adoption of corpus analysis against the ad hoc tendency (e.g., Deignan and Potter 2004), and the application of (critical) discourse analysis to study metaphors translation in focused discourse (e.g., Schäffner 2004). Entwined with these advancements, cognitive metaphor theories further fuel relevant discussions. For example, Enrico Monti (2009) evaluates the law of translatability in Raymond van den Broeck (1981) by analyzing the translations of conceptual metaphors in *Metaphors We Live By* (1980) from English into French, Italian, and Spanish. Moreover, following Newmark’s (1980) idea of metaphor categorization, Khadidja Merakchi and Margaret Rogers (2013) and Simon Tebbit and John J. Kinder (2016) recruit conceptual metaphor theories to investigate the translation of different types of metaphors in scientific texts and the bible respectively. Building on norm theory, Luciana Sabina Tcaciuc and Vladislav Mackevic (2017) examine translators’ agency by tracing the translations of metaphorical expressions falling under the conceptual metaphor THE ECONOMY IS A MACHINE. More recently, David Ritchie and Xue-De Zhao (2020) recruit

conceptual metaphor theory and perceptual simulation theory to test appraisal methods of poetry translation centered around metaphors.

More importantly, building on Christina Schäffner and Mark Shuttleworth (2013), Shuttleworth (2017) provides a systematic introduction of metaphor parameters to descriptive translation studies. These parameters help to deconstruct the compound of metaphor and offer clearer insights into how metaphors have been translated across languages. It is shown that concepts extracted from metaphor theories can function as a powerful tool to describe translation behavior, covering both quantitative and qualitative perspectives.

The ongoing conversation between metaphor studies and translation studies reinforces the mutual-beneficial relationship between the two disciplines, which creates new possibilities to develop the interdisciplinary area. As the literature shows, most of the existing research draws on conceptual metaphor theory (CMT) proposed by Lakoff and Johnson (1980), which is ostensibly congenial. The basic mechanism of CMT is exemplified in figure 1. CMT deconstructs a conceptual metaphor into two parts: 1) a target domain (e.g., ARGUMENT) that contains the topical information; 2) a source domain (e.g., WAR) that provides referential resources to facilitate the discussion of the topic. These conceptual domains are linked by mappings—the systematic correspondences between the source and the target domains.

Figure 1. ARGUMENT IS WAR in Dancygier (2016, 30)



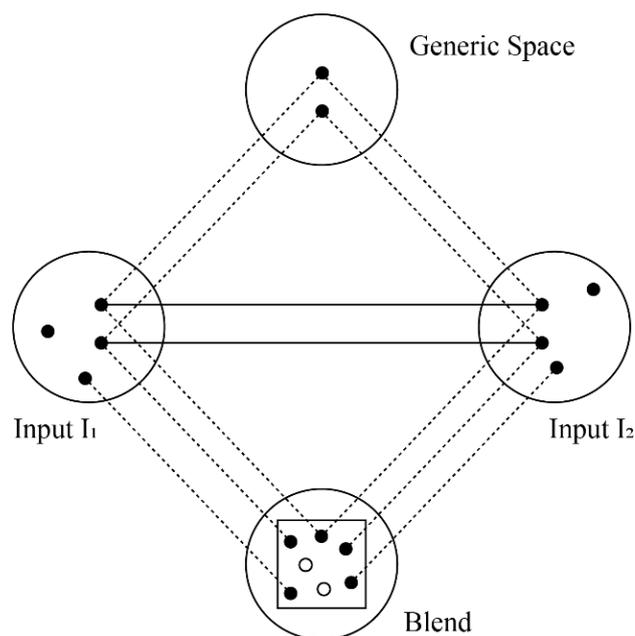
As Jonathan Charteris-Black (2004, 11) and Elena Semino (2008, 9) argue, because CMT focuses on conceptual metaphors at the level of conceptual domain, it unavoidably fails

to include discursive information, which is obviously key to translation research. To address this mechanical defect of CMT, metaphor scholars have adopted conceptual blending theory (CBT) proposed by Gilles Fauconnier and Mark Turner (2002) as a complementary angle (e.g., Grady, Todd, and Coulson 1999; Fauconnier and Lakoff 2014; Dancygier 2016; Kövecses 2020).

Compared to the two-dimensional model of CMT, the CBT model contains a space called “the blend,” where relevant information is projected from the source and the target input spaces onto the blend for retrieving meanings (figure 2). Notably, figure 2 presents a minimal diagram of the CBT model, and the actual cognitive mechanism of our brain is way more complex: instead of activating four mental spaces, multiple networks may be activated at the same time to understand certain things.

The minimal model presented in figure 2 comprises several mental spaces, including two input spaces, a generic space, and a blend. Input spaces denote source information (usually textual and contextual information for metaphor translation analyses) required for meaning-making; the generic space contains the information shared by input spaces; the blend is the mental space where meaning is constructed, drawing on information contained in the input spaces guided by the common structures in the generic space.

Figure 2. Basic diagram of CBT in Fauconnier and Turner (2002, 46)



The circles depicted in the figure represent mental spaces, which denote the “small conceptual packets constructed as we think and talk, for purposes of local understanding and action” (Fauconnier and Turner 2002, 40). Because this model draws on input spaces, it is more specific than the information contained in conceptual domains in CMT. It conveys contextual information that is missing from the CMT framework. This sheds new light on metaphor translation research, where contextual information and linguistic metaphorical expressions weigh no less, if not heavier, than conceptual metaphors.

Guided by the method proposed by Sui He (2021) which brings CMT and CBT into conversation, the case study presented below delineates metaphor translation into the translation of conceptual metaphors (CMT) and metaphorical expressions (CBT) in hope of showing how metaphors relating to scientific discoveries have been translated from English into Chinese in popular science communication, and presenting the insights that this case study sheds for future research on metaphor translation in other discourses and/or with other focuses.

3. Methodology

Metaphorical expressions discussed in the case study were sourced from seven cosmological articles published in *Scientific American* and its two official Chinese editions: 《环球科学》 *Huanqiukexue* (global science), published in Simplified Chinese in Beijing; and 《科學人》 *Kexueren* (science person), published in Traditional Chinese in Taipei (see Appendix).

Scientific American was selected as the source text (ST) for its authoritative status in the popular science publishing industry, which gives higher credibility to the quality and impact of its translations. According to Maeve Olohan (2016, 174), *Scientific American* includes articles written by specialist scientists for a group of educated readers who are interested in science but normally with little understanding of science from their targeted domains. With the target audience in mind, *Scientific American* articles employ more metaphorical expressions than academic texts (Knudsen 2003, 1257). For the two target texts (TTs), most of the translators are astrophysicists and all of them have academic backgrounds in either physics or cosmology.

Examples were manually identified following three steps. First, metaphor identification procedure (MIP) proposed by Pragglejaz Group (2007) was applied to collect metaphorically used segments. The basic idea of MIP is to compare the basic meaning of a segment with its

contextual meaning. That is to say, if the basic meaning of a lexical item obtained from corpus-based dictionaries (e.g., Macmillan Dictionary) is different from its contextual meaning, it is coded as metaphorically used. Second, Richard Boyd's (1993, 485–486) categorization of metaphors in science communication—pedagogical metaphors and theory-constitutive metaphors—was adopted to shortlist the candidates. Third, only metaphorical expressions employed to describe scientific discoveries and scientific experiments in their given contexts were included in the final list. The identification of metaphorical expressions in Chinese follows the aforementioned criteria, alongside the referential examples set by Ben Pin-Yun Wang et al. (2019). In total, ten examples were identified.

These examples were examined with a metaphor parameter called “projection,” representing the content of metaphor. In CMT, it denotes the mapping of a conceptual metaphor delineated by conceptual domains presented in smaller capital letters. For example, LIFE IS A JOURNEY, with LIFE representing the target domain (the topic being described) and JOURNEY representing the source domain (the vehicle used for describing the topic). In CBT, projection denotes the mental spaces that contain contextual information of linguistic metaphors. For example, ‘I am at a crossroad of my life’ has two input spaces: ‘life involves choices’ and ‘crossroad denotes a place where two roads meet and cross each other.’ As shown in figure 2 (in section 2), the process of blending involves multiple steps, which makes it nearly impossible to verbalize the whole process. Therefore, to represent metaphorical expressions in the CBT framework, only input spaces were verbalized, which serve as a grounding for further reasoning. Input space 1 contains contextual information which serves as a background for retrieving the meaning of lexical items in given contexts. Input space 2 contains lexical information of specific wordings. The verbalization of input spaces 1 and 2 (context plus text) makes it feasible to describe metaphor translation in the CBT framework without compensating the elements needed for the analysis. Notably, because CBT deals with cognitive linguistics in general, it not only applies to metaphor analysis but also non-metaphorical language, the power of which is revealed in the analysis in sections 4 and 5.

Translation solutions adopted for analyzing the rendering of these metaphors are listed and explained as follows:

- (1) Retention, when the original conceptual metaphor is preserved in the TT.

(2) Modification, when the metaphoricity is retained but with an altered conceptual metaphor.

(3) Removal, when the contextual meaning is retained but the metaphoricity is removed.

(4) Omission, when both contextual meaning and metaphoricity are omitted.

(5) Addition, when there is no metaphor in the ST but translators add metaphor in the TT.

The combination of translation solutions and the projection parameter makes it feasible to investigate the translation of metaphor at cognitive and linguistic levels, with a specific focus on the translation of the content that metaphors carry in context. The following sessions showcase how this method was applied to analyze the examples, starting with the group of metaphors relating to ‘scientific discoveries,’ followed by the group relating to ‘scientific experiments.’

4. Scientific Discoveries

Among the examples, the source domains relating to scientific discoveries include JOURNEY, HUMAN, and COMPETITION. The translational features of these examples are diverse. As the discussion shows, conceptual metaphors crystallized under the power of CMT (and domains) provide a satisfying organizing structure for analyzing metaphorical expressions and their translations in specific contexts on the grounding of CBT (and input spaces).

Starting with SCIENTIFIC DISCOVERY IS A JOURNEY, the metaphorical expressions hosted by this conceptual metaphor convey contextual information, featuring different aspects of JOURNEY: “the wrong road” (example 1), “partway” (example 2), “the rest of the way” (example 3), and “a dead end” (example 5). The source domain of JOURNEY has been recognized as a common source domain for experience-related target domains in English and Chinese (e.g., Lakoff and Johnson 1980, 2003; Yu 1998). Examples in the current paper echo this finding: among the four metaphorical expressions, three of them (examples 1, 2, and 5) were simultaneously retained in the TTs. Example 1 presented below is a case in point.¹

¹ ST refers to *Scientific American*; TT1 refers to the Simplified Chinese version; TT2 refers to the Traditional Chinese version; GTS denotes grand translation solution; mapping denotes conceptual metaphor; input spaces represent cognitive components that help to form metaphorical expressions. Metaphorical expressions are highlighted in bold, and non-metaphorical segments with metaphorical counterparts in the ST/TT are underlined. The back-translations of the target segments are provided by the authors as references.

Table 1. Example 1 – Road

Source article: “Pop Goes the Universe,” February 2017.	
[ST]	History teaches us that this is the wrong road to take.
Mapping	SCIENTIFIC DISCOVERY IS A JOURNEY
Input space 1	Scientific discovery has various directions and methods.
Input space 2	Road denotes a way that leads from one place to another.
[TT1]	这条路是错误的 <i>zhe tiao lu shi cuowu de</i> (this road is wrong)
GTS	Retained
Mapping	SCIENTIFIC DISCOVERY IS A JOURNEY
Input space 1	Scientific discovery has various directions and methods.
Input space 2	<i>Lu</i> (road) denotes a way that leads from one place to another.
[TT2]	這條路行不通 <i>zhe tiao lu xingbutong</i> (this road is not walkable)
GTS	Retained
Mapping	SCIENTIFIC DISCOVERY IS A JOURNEY
Input space 1	Scientific discovery has various directions and methods.
Input space 2	<i>Lu</i> (road) denotes a way that leads from one place to another.

The keyword “road” evokes a universal image of choosing between potential paths to reach a destination, which is conventionally used in English and Chinese as validated in monolingual corpora. Both the input spaces and the mapping were retained in the TTs, despite the discrepancy in rendering the adjective “wrong.” Interestingly, the translations of this adjective—错误的 *cuowu de* (wrong) and 行不通 *xingbutong* (not walkable, meaning this approach does not work)—echo input space 1 and input space 2 of the source segment. The translation in *Huanqiu kexue* focuses on the practical outcome of a “wrong” path as conveyed in input space 1, whilst in *Kexueren*, “walk” resonates with the travel-related knowledge in input space 2.

As for examples 2 and 3, both examples fall under the JOURNEY metaphor, but as they were used in two consecutive sentences in the ST, the translation solutions for these examples are different: “We could begin by deploying a large cavity volume with a strong magnetic field – that would bring us partway (example 2) to the sensitivity we want. To go the rest of the way (example 3), we knew we would need better microwave amplifiers.”

Table 2. Example 2 – Partway

Source article: “Searching for the Dark,” January 2018.	
[ST]	That would bring us partway to the sensitivity we want.
Mapping	SCIENTIFIC DISCOVERY IS A JOURNEY

Input space 1	Deploying a new method can increase the sensitivity of a sensor.
Input space 2	Partway means some of the distance to a place.
[TT1]	这会让我们离期望的灵敏度更进一步 <i>hehui rang women li qiwan de lingmindu gengjin yibu</i> (this will allow us to take a step forward to the level of sensitivity we want)
GTS	Retained
Mapping	SCIENTIFIC DISCOVERY IS A JOURNEY
Input space 1	Deploying a new method can increase the sensitivity of a sensor.
Input space 2	<i>Gengjin yibu</i> means to move a step forward towards the destination.
[TT2]	使我們大約達到所需的靈敏度 <i>shi women dayue dadao suoxu de lingmindu</i> ([this] allows us to almost reach the required level of sensitivity)
GTS	Retained
Mapping	SCIENTIFIC DISCOVERY IS A JOURNEY
Input space 1	Deploying a new method can enable scientists to obtain a sensitivity that is more or less required by the experiment.
Input space 2	<i>Dadao</i> means to reach a destination.

As shown in input space 2 of the source segment, “partway” has the basic meaning of “some of the distance to a place”² in Macmillan Dictionary Online. The conceptual metaphor was retained as 更近一步 *gengjin yibu* (to take a step forward) in *Huanqiukexue* and 達到 *dadao* (to reach) in *Kexueren* but there is a shift at the input space level. While the translation in *Huanqiukexue* shares a similar input space as the source segment as somewhere alongside the journey, it was modified in *Kexueren*, as revealed by the input spaces 2 of the *Kexueren* rendering: a shift of the contextual meaning from “partway” to “end-of-the-way.”

Interestingly, example 3 “the rest of the way,” found in the following segment, was simultaneously removed in the TTs. The concern of repeating the same mapping in two consecutive sentences might be a reason. Similar in both translations, this segment was shorted as 而剩下的 *er shengxia de* (and the remainder) in *Huanqiukexue* and 要達成這點 *yao dacheng zhedian* (to reach this point) in *Kexueren*, rather than retaining the whole segment as “to go the rest of the way” in the original.

Table 3. Example 3 – The rest of the way

Source article: “Searching for the Dark,” January 2018.	
[ST]	To go the rest of the way , we...
Mapping	SCIENTIFIC DISCOVERY IS A JOURNEY

² Macmillan Dictionary Online, s.v. “partway,” accessed May 4, 2020, <https://www.macmillandictionary.com/dictionary/british/partway>.

Input space 1	Scientific discovery is a continuous process.
Input space 2	The rest of the way refers to the forthcoming journey that one needs to take in order to reach a destination.
[TT1]	而剩下的 <i>er shengxia de</i> (and the remainder)
GTS	Removed
Mapping	N/A
Input space 1	This line of research is in development.
Input space 2	<i>Shengxia de</i> means the remaining parts needed to be worked on.
[TT2]	若要達成這點 <i>ruoyao dacheng zhedian</i> (if we want to reach this point)
GTS	Removed
Mapping	N/A
Input space 1	This line of research has a goal.
Input space 2	<i>Dacheng zhedian</i> means there is a final goal to be achieved.

Moving away from syntactical features as such, translators' tactic handling of 'mixed metaphors,' i.e., metaphors of very different source domains are used in each other's (near-)vicinity (Gibbs 2016, 3), is shown in examples 4 and 5. Notably, because CBT deals with human language in general, it not only helps to reveal the changes made in retention and modification examples, but also works for non-metaphorical ones, as featured in removal and added cases. The Traditional Chinese translation (TT2) of example 4 is a case in point, where the contextual information in input space 1 and the lexical meaning of 初期階段 *chuji jieduan* (initial stages) come to a blend for realizing the meaning of this lexical item in this context.

Table 4. Example 4 – Young

Source article: "Is Dark Matter Real?" August 2018.	
[ST]	This line of research is young and might turn out to be a dead end.
Mapping	RESEARCH IS A HUMAN
Input space 1	This line of research has been in existence only for a short while.
Input space 2	Young means someone has lived for only a short time.
[TT1]	剛剛起步的研究方向 <i>ganggang qibu de yanjiu fangxiang</i> (a newly started research direction)
GTS	Modified
Mapping	RESEARCH IS A JOURNEY
Input space 1	This line of research just passed the starting point.
Input space 2	<i>Qibu</i> (literally, start the step) means someone taking the initial departure on a journey.
[TT2]	這個研究方向還在初期階段 <i>zhege yanjiu fangxiang haizai chuji jieduan</i> (this research direction is still at its early stage)
GTS	Removed
Mapping	N/A

Input space 1	This line of research has been in existence only for a short while.
Input space 2	<i>Chuji jieduan</i> means something is at its initial stages.

Table 5. Example 5 – Dead end

Source article: “Is Dark Matter Real?” August 2018.	
[ST]	This line of research is young and might turn out to be a dead end .
Mapping	RESEARCH IS A JOURNEY
Input space 1	Research has different paths that can lead to different outcomes.
Input space 2	Dead end means the road hits an end.
[TT1]	有可能最后是一个死胡同 <i>you keneng zuihou shi yige si hutong</i> (might turn out to be a dead <i>hutong</i>)
GTS	Retained
Mapping	RESEARCH IS A JOURNEY
Input space 1	Research has different paths that can lead to different outcomes.
Input space 2	A dead <i>hutong</i> denotes a closed-up street.
[TT2]	或許最終會走進死胡同 <i>huoxu zuizhong hui zoujin si hutong</i> (might end up walking in a dead <i>hutong</i>)
GTS	Retained
Mapping	RESEARCH IS A JOURNEY
Input space 1	Research has different paths that can lead to different outcomes.
Input space 2	A dead <i>hutong</i> denotes a closed-up street.

Examples 4 and 5 were used alongside each other, with the same grammatical function in the same sentence. As shown in the mappings, both the JOURNEY and the HUMAN source domains are commonly used in popular cosmological texts. However, the systematicity of “a dead end” is stronger than that of “young” in the source article. As a result, while example 4 “young” was modified into a JOURNEY metaphor in *Huanqiukexue* under the close relation between example 5 “a dead end” and the main theme in the source text, this metaphorical expression was removed and rendered non-metaphorically in *Kexueren*.

Even though many scholars argue that the usage of mixed metaphors is common, this argument has in most cases been made in the English-speaking context. As can be speculated from the Chinese translations, the conceptual conflict between “young” and “dead end” in their proximity has seemingly caused problems for translators. Retaining both metaphors in Chinese translation is highly likely to cause a grammatical error, where an adjective does not match the noun it serves. This example provides an insight into metaphor’s sensitivity to linguistic contexts, revealed by the joint power of conceptual metaphors and metaphorical expressions.

Apart from the HUMAN conceptualization, another one-shot metaphORIZATION of SCIENTIFIC DISCOVERY was found: an added example in *Kexueren*, which describes “the space age” as “the age of space competition.”

Table 6. Example 6 – The space age

Source article: “Cassini at Saturn,” October 2017.	
[ST]	Before <u>the space age</u> , scientists thought the moons of the outer solar system would be featureless, geologically dead balls of ice.
Mapping	N/A
Input space 1	Space exploration has been considered as a primary task by many countries as a military response to geo-political conditions.
Input space 2	The space age denotes a period of the space race, starting on October 4, 1957, when the Soviet Union launched Sputnik, the world’s first artificial satellite.
[TT2]	太空競賽時代 <i>taikong jingsai shidai</i> (the age of space competition)
GTS	Added
Mapping	SCIENTIFIC DISCOVERY IS A COMPETITION
Input space 1	Countries use the cosmos as a competition platform.
Input space 2	The space age denotes a time when countries were intensively competing against each other in the realm of space.

In this example, “the space age” denotes the time when human beings were not able to send spacecraft into the universe for scientific enquiries. Under this metaphor, scientific discovery of the universe is portrayed as a competition between scientists, and scientists are described as competitors. The source domain of COMPETITION was not identified in the source segment nor in the whole ST. Therefore, the metaphorical expression added in the translation, together with the conceptual metaphor it carries, represents a stand-alone instance in the translation, with no connections to metaphors used by the author in the ST.

5. Scientific Experiments

For the metaphorical expressions centered around scientific experiments, four examples were identified: “bear fruit” (example 7), “concert” (example 8), “白卷 *baijuan* (blank answer sheets)” (example 9, added in *Kexueren* for “null results”), and “夭折 *yaozhe* (die young)” (example 10, added in *Huanqiukexue* for “get off the ground”).

Compared to scientific discoveries, metaphors used to describe scientific experiments are more specific, and the source domains associated with this topic are more novel and unique.

Apart from example 10, all other metaphorical expressions are stand-alone ones, meaning that these expressions do not share any systematic relationships with other examples identified in the STs. Similar to section 4, the organizing structure at the level of conceptual metaphors provides guidance for analyzing metaphorical expressions. In this section, however, it can be seen more clearly from the examples that CBT, operating on the level of mental spaces, is powerful in analyzing novel and stand-alone examples alongside the general picture that CMT provides.

Starting with example 7, “bear fruit” is a conventionalized metaphor with an entry denoting its metaphorical meaning of “having successful results”³ in Macmillan Dictionary Online. The metaphorical expression falls under the SCIENTIFIC EXPERIMENTS ARE CULTIVATION metaphor.

Table 7. Example 7 – Bear fruit

Source article: “How to Swallow a Sun,” April 2017.	
[ST]	In 1988 astronomer Martin Rees proposed a third way to study supermassive black holes – a method that has recently begun to bear fruit .
Mapping	SCIENTIFIC EXPERIMENTS ARE CULTIVATION
Input Space 1	A new method to study supermassive black holes produces more insights.
Input space 2	Bear something means to produce flowers or fruits. In this sentence, the literal meaning of “bear fruit” is “to produce fruit.”
[TT1]	显示出了它的优越性 <i>xianshi chule ta de youyuexing</i> (to show its advantages)
GTS	Removed
Mapping	N/A
Input space 1	A new method to study supermassive black holes produces more insights.
Input space 2	<i>Youyuexing</i> means having more advantages compared to the other options.
[TT2]	獲得成果 <i>huode chengguo</i> (to obtain ripe fruits)
GTS	Retained
Mapping	SCIENTIFIC EXPERIMENTS ARE CULTIVATION
Input space 1	A new method to study supermassive black holes produces more insights.
Input space 2	<i>Chengguo</i> means to produce fruits.

The word-for-word translation of this expression—成果 *chengguo* (to become fruits)—is a conventional expression in Chinese, usually used as a noun, meaning “the successful outcomes of something.” This default translation was chosen by *Kexueren* translators, leading

³ Macmillan Dictionary Online, s.v. “bear fruit,” accessed May 4, 2020, <https://www.macmillandictionary.com/dictionary/british/bear-fruit>.

to the retention of the original mapping and input spaces. By contrast, this example was translated as 显示出了它的优越性 *xianshi chule tade youyuexing* (to show its advantages) in *Huanqiukexue*. As a result, the metaphoricity of this expression was removed. More importantly, the original figurative meaning of the source segment was also altered, as can be seen in the two input spaces. The *Huanqiukexue* version focuses on the advantage of this method compared to all other methods, whilst in the ST and *Kexueren*, the emphasis is on the “fruits” that the method yields. This mirrors example 6 “the space (competition) age” presented in section 4. Although there is no trace of the “competition” element in the STs, added information was found in the translation.

Another metaphorical expression identified in the ST belongs to the SCIENTIFIC EXPERIMENTS ARE CONCERTS metaphor. Whilst example 7 “bear fruit” reveals the dynamics between conventionality and translator’s intervention, this example displays the clash of conventionality in different cultures that leads to a removal in the TTs, as revealed by the input spaces.

Table 8. Example 8 – Concert

Source article: “Searching for the Dark,” January 2018.	
[ST]	ADMX has many complicated parts that must all work in concert .
Mapping	A SCIENTIFIC EXPERIMENT IS A CONCERT
Input space 1	ADMX has complicated parts, which need to function as a whole.
Input space 2	A concert involves different musicians playing different instruments working in harmony.
[TT1]	ADMX 实验由许多复杂的部分组成，这些部分必须要协同工作 <i>ADMX shiyan you xuduo fuzha de bufen zucheng, zhexie bufen bixu yao xietong gongzuo</i> (ADMX experiment comprises many complex parts; these parts must collaborate and work with each other)
GTS	Removed
Mapping	N/A
Input space 1	ADMX has complicated parts, which need to function as a whole.
Input space 2	<i>Xietong gongzuo</i> means to work collaboratively.
[TT2]	ADMX 結構複雜，各部分需協同運作 <i>ADMX jiegou fuze, ge bufen xu xietong yunzuo</i> (The structure of ADMX is complicated; each part needs to collaborate and work with each other)
GTS	Removed
Mapping	N/A
Input space 1	ADMX has complicated parts, which need to function as a whole.
Input space 2	<i>Xietong yunzuo</i> means to operate collaboratively.

The expression “in concert” is a metaphorical idiom in English, meaning to work together with somebody or something. This expression does not have a convenient translation in Chinese although the generic meaning it conveys is obvious and universal. The notion of “concert” is not indigenous to Chinese culture. Chinese idioms that describe the idea of harmony with a reference to musical instruments mainly resort to traditional Chinese instruments, but these Chinese idioms tend to be used exclusively in their designated contexts. For example, 琴瑟和鸣 *qin se he ming* (the harmonious performance of *qin* and *se*, two traditional Chinese musical instruments) is for describing harmonious marital relationships. If this idiom is used in a different context, e.g., to describe a collegial relationship, it can be regarded as a grammatical mistake because this idiom is used out of the formal context, known as 成语误用 *chengyu wuyong* (misuse of idioms) in Chinese language education. The lack of correspondence in Chinese can explain this removal decision. Due to the differences in the bodily experience of different cultures, there is no guarantee that every metaphor is universally shared. The cultural differences embedded in languages can lead to different linguistic realizations of metaphors and influence the translation of culturally distant metaphorical expressions.

Finally, for the two added examples in this group, example 9 “null results” is a stand-alone expression, and example 10 “get off the ground” falls into a major metaphor network identified in the ST.

Table 9. Example 9 – Null results

Source article: “Black Holes from the Beginning of Time,” July 2017.	
[ST]	As <u>null results</u> piled up in the search for WIMPs, some researchers began reconsidering the MACHO hypothesis, focusing particularly on primordial black holes.
Mapping	N/A
Input space 1	Experiments on WIMP yield results that are either right or wrong, which directs scientists to further investigations.
Input space 2	Null results denote the wrong answers in searching for a specific kind of particle (WIMP).
[TT2]	當搜索 WIMP 的實驗繳出越來越多的白卷 <i>dang sousuo WIMP de shiyan jiaochu yuelaiyueduo de baijuan</i> (when the experiments on WIMP hand in more and more black answer sheets)
GTS	Added

Mapping	SCIENTIFIC EXPERIMENTS ARE EXAMINATIONS / WIMP EXPERIMENTS ARE EXAMINEES
Input space 1	Experiments on WIMP yield results that are either right or wrong, which directs scientists to further investigations.
Input space 2	<i>Baijuan</i> (white paper sheets) means blank answer sheets.

As the input spaces and the mapping of the translation show, the focus of this added metaphor, on both linguistic and cognitive facets, is on the results of these experiments, which is in line with the source segment. Arguably, this expression could be a literal one, depending on the layout of the reports generated from these experiments. However, the reason why this expression was included as an example lies in the indicative verb 缴 *jiao* (to hand in). Portraying scientists as examiners, this verb personifies the experiments on WIMP as examinees and the noun 白卷 *baijuan* (blank answer sheets) reveals the metaphorization of general experiments as examinations. This evokes a rich image in *Kexueren*, displaying the strong communicative function of metaphor alongside its cognitive power.

Turning to example 10, the HUMAN source domain was found. This source domain has been widely used in popular cosmological texts. Although this example belongs to the target domain of SCIENTIFIC EXPERIMENT and it is the only instance in the group, it shares a close relationship with other examples centered around the topic of space exploration identified in the dataset.

Table 10. Example 10 – Get off the ground

Source article: “Pluto Revealed,” December 2017.	
[ST]	...the mission almost never got off the ground
Mapping	N/A
Input space 1	The mission on Pluto was almost abandoned before it was launched.
Input space 2	“Get off the ground” means the launch of a spacecraft to study Pluto.
[TT2]	这项任务差点儿就夭折了 <i>zhexiang renwu chadian'er jiu yaozhe le</i> (this mission almost died young/this mission was almost aborted)
GTS	Added
Mapping	SCIENTIFIC EXPERIMENTS ARE HUMANS (BABIES)
Input space 1	The planetary mission on Pluto was almost abandoned before it was launched.
Input space 2	<i>Yaozhe</i> denotes the death of an infant or a child before adulthood.

This added metaphor was employed to describe a scientific experiment, which was set to advance the scientists’ exploration of Pluto. This contextual information pulls the example

to the borderline between the concrete domain of SCIENTIFIC EXPERIMENT and the general domain of SPACE EXPLORATION. Personification elements have been frequently used in popular cosmological articles to describe space exploration, especially when talking about spacecraft and scientific instruments. Although this example is at the borderline, it reveals a notable pattern of added examples in metaphor translation: most of the additional metaphorical expressions identified in the TTs are closely related to the main mappings of the STs. The input spaces of these added examples can be different from those in the ST, but the mapping is preserved at a conceptual level. This feature does not come up as robust in the small-scale case study, but it does make a solid statement in larger projects (e.g., He 2022).

6. Conclusion

This case study redresses the importance of linguistic data and text analysis in translation research. As the case study shows, the application of aligning CMT and CBT for translation analysis is promising because it provides a theoretical framework for analyzing metaphor translation at both cognitive and linguistic levels situated in specific cultural-linguistic contexts. This alignment not only provides a theoretical grounding for studying metaphor translation from a cognitive perspective but also showcases the complementary insights that different theories can shed as an advantage of adopting eclectic approaches for research purposes.

Additionally, the introduction of the projection parameter makes it possible to analyze metaphor translation within a feasible scope. This initial attempt unleashes the potential to experiment with other metaphor parameters in an eclectic way, for investigating the general topic of metaphor translation in various discourses. As Monti (2009, 219) rightly observes, some metaphorical expressions are new to a target language, yet they are comprehensible to the target audience because some conceptual metaphors are shared between languages. This echoes Toury's (1989, 243) argument on the discussion of translation shifts and the norms that govern metaphor translation: the line between normative and non-normative translation behaviors in this situation is obscure. This statement holds true for culturally distant languages such as English and Chinese as shown in the case study. With the inclusion of metaphor parameters, it is feasible for future research of similar lines to design metaphor translation research and draw comparisons between different language pairs across different genres. This echoes the

important appeal of enhancing the replicability made by Christian Olalla-Soler (2020), with the aim to advance descriptive methods and strengthen the credibility of empirical research.

With the help of metaphor parameters and cognitive theories, with more robust descriptive data at hand, we will be in a better position to reveal and reflect on the dynamic norms governing these highly diversified translation activities relating to metaphor.

Appendix

List of Articles

- 1. ST:** “Pop Goes the Universe.” By Anna Ijjas, Paul J. Steinhardt, and Abraham Loeb. *Scientific American* 316 (2): 32–39. February 2017.

TT1: “宇宙大爆炸不曾发生?” *yuzhou dabaozha buceng fasheng?* (The Big Bang did not happen?) Translated by Tao-tao Qiu. *Huanqiukexue*. March 2017.

TT2: “戳破宇宙暴脹” *chuopo yuzhou baozhang* (Puncture the inflated universe.) Translated by Wo-lung Lee. *Kexueren*. April 2017.
- 2. ST:** “How to Swallow a Sun.” By S. Bradley Cenko, and Neil Gehrels. *Scientific American* 316 (4): 38–45. April 2017.

TT1: “现场直击：黑洞吞噬恒星” *xianchang zhiji: heidong tunshi hengxing* (Live: Black hole gorges stars.) Translated by Yan-ting Dong, and Dongyue Li. *Huanqiukexue*. May 2017.

TT2: “黑洞進食秀” *heidong jinshixiu* (The dining show of black holes.) Translated by Wo-lung Lee. *Kexueren*. September 2017.
- 3. ST:** “Black Holes from the Beginning of Time.” By Juan García-Bellido, and Sébastien Clesse. *Scientific American* 317 (1): 38–43. July 2017.

TT1: “暗物质是原初黑洞?” *anwuzhi shi yuanchu heidong* (Is the dark matter the original black hole?) Translated by Lei Qian. *Huanqiukexue*. August 2017.

TT2: “時間起點的黑洞” *shijian qidian de heidong* (Black holes at the beginning of time.) Translated by Wo-lung Lee. *Kexueren*. December 2017.
- 4. ST:** “Cassini at Saturn.” By Carolyn Porco. *Scientific American* 317 (4): 78–85. October 2017.

TT1: “卡西尼号的三大遗产” *kaxini hao de san da yichan* (The three heritages of Cassini.) Translated by Jianghui Ji, and Mengrui Pan. *Huanqiukexue*. November 2017.

TT2: “卡西尼号 荣耀土星” *kaxini hao rongyao tuxing* (Cassini, the glory at Saturn.) Translated by Shu-hui Chiu. *Kexueren*. November 2017.
- 5. ST:** “Pluto Revealed.” By S. Alan Stern. *Scientific American* 317 (6): 40–47. December 2017.

TT1: “新视野号：重新认识冥王星” *xinshiye hao: chongxin renshi mingwangxing* (New horizon: Renewing our understanding of Pluto.) Translated by Yong-chun Zheng, and Han Liu. *Huanqiukexue*. January 2018.

TT2: “冥王星第一手報告” *mingwangxing diyishou baogao* (The first-hand report on Pluto.) Translated by Shu-hui Chiu. *Kexueren*. January 2018.

6. **ST:** “Searching for the Dark.” By Leslie Rosenberg. *Scientific American* 318 (1): 51–57. January 2018.
TT1: “轴子：暗物质新可能” *zhouzi: anwuzhi xin keneng* (Axions: The new possibility for dark matter.) Translated by Xiao-peng Zhou. *Huanqiukexue*. February 2018.
TT2: “打造轴子侦测器” *dazao zhouzi zhenceqi* (Building the axion detector.) Translated by Ching-hao Chen. *Kexueren*. March 2018.
7. **ST:** “Is Dark Matter Real?” By Sabine Hossenfelder, and Stacy S. McGaugh. *Scientific American* 319 (2): 36–43. August 2018.
TT1: “宇宙没有暗物质?” *yuzhou meiyou anwuzhi* (There is no dark matter in the universe?) Translated by Shao-jiang Wang, and Tong-bo Liu. *Huanqiukexue*. September 2018.
TT2: “真的需要暗物质?” *zhende xuyao anwuzhi* (Is dark matter really a must?) Translated by Wo-lung Lee. *Kexueren*. November 2018.

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