

Embodiment in Cognitive Translation Studies

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Abstract Various notions of embodiment have been suggested in Cognitive Translation Studies (CTS), but it is unclear how they relate and how they can be reconciled. In this chapter, I discuss three different views on embodiment and suggest the Free Energy Principle (FEP)/Active Inference as a mathematical/empirical research framework to integrate these positions. FEP/Active Inference is agnostic with respect to the embodiment position and can be deployed to underpin the different notions of embodiment.

Keywords Embodiment and enactivism in translation. Body functionalism. Body enactivism. The Free Energy Principle and Active Inference. Boundaries of the translating mind.

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1 Introduction

With the emergence of what is now sometimes called Cognitive Translation Studies (CTS) in the mid-1980s, translation scholars started investigating what happens in the minds of translators (Krings 1986) – how translators create meaning, how they arrive at their strategies and choices, how translation competence is developed, how cultural and linguistic factors impact their translated text as well as their thinking and behavior. CTS in this line of research “refer to and expand” (Risku 2012, 675) models of the mind in Cognitive Science as introduced in the 1970s and 1980s, to explain translators’

behaviour and choices. Accordingly, CTS has for a long time understood translational cognition in terms of mental representations and internal computational processes, only.

This classical computational paradigm has been challenged by scholars who follow embodied and situated theories of cognition. While traditional models describe the mind as separated from the environment, situated theories consider cognition as agent-environment interaction (Chemero 2010; Gallagher 2017). These theories are known as 4E theories, and they endorse the

fundamental thesis [...] that the mind is not in the head, at least not in some notable parts - that it extends to the whole body, and even beyond it. (Pernu 2017)

However, there have been different, sometimes conflicting voices in CTS regarding the validity of traditional models and their compatibility with situated cognition. Risku (2012) seems to reject classical views, including connectionism, in favor of situated cognition. Muñoz (2017, 561) considers a situated view of cognition as “mutually exclusive”, and “by no means complementary” to traditional information-processing models. In contrast, O’Brien (2017, 321) argues that for traditional models and situated models,

it is not a question of choosing either one model or the other, but rather that each model offers different insights into the cognitive processes we are interested in.

Similarly, Alves and Jakobsen (2020, 547) maintain that the “paradigmatic and methodological differences” between the two “are best addressed from a complementary, integrative approach”.

This chapter suggests the Free Energy Principle (FEP, Friston 2009; 2010; 2013) and Active Inference (Parr, Pezzulo, Friston 2022) as a framework (i.e., a principle) which has the potential to account for a wide range of different philosophical interpretations, including traditional and situated cognitive approaches, representationalism vs non-representationalism, internalist vs. externalist CTS. I will first lay out three different notions of embodiment, as suggested by Kiverstein (2012) and relate them to different recent theories within CTS. Within CTS, positions have been supported which view the body as a mere input device, which assume a functional/causal contribution of the body, or which take an embodiment perspective in which the environment is a genuine part of cognitive processes. Kiverstein argues that the main differences of these theories consist in different conceptualizing the boundaries of the mind and the assumed relation between brain, mind and meaning. The FEP provides an empirical research paradigm for CTS which can accommodate these different approaches.

2 Three approaches to embodiment for translation

The notion of 4EA cognition (Embodied, Embedded, Extended, Enacted, Affective) has entered CTS for some time (Muñoz 2010; Risku 2012), but different authors seem to have different understandings of the term. In order to illustrate differences of embodiment positions, Kiverstein (2012) introduced a taxonomy that makes a distinction between three types of embodiments:

1. *body conservatism* holds that the body contributes to information processing only by supplying inputs to the brain, or by executing motor instructions.
2. *body functionalism* assumes that the contribution of the body is functional/causal. The brain computes and represents and takes the role of a controller while the body underpins our cognitive capacities, implementing computational machinery.
3. *body enactivism* maintains that brain-body-environment interaction is the source of meaning, and that this interaction is constitutive of cognition.

I will argue that these distinctions are also suited to characterize different positions within CTS with some adjustments. In Kiverstein's conception positions 1 and 2 are compatible with Fodor's idea of the "computer theory of mind", which stipulates that the mind is a function of the brain: it is modular, consisting of domain-specific perceptual and motor processes as well as a central general-purpose processor, the latter of which computes thought and reason. While there is no place for the body in its original formulation, positions 1-2 extend this picture of the computer theory of mind so as to make room for the body. Functionalists, but not conservatives, aim at enriching this

traditional idea of computation so as to open up space for body and environment to play a role in implementing information processing. (Kiverstein 2012, 743)

The main difference between body functionalism and body enactivism, i.e., positions 2-3, boils down to whether one claims the body and the environment make a causal contribution, or the more radical claim whether body and environment are assumed to be 'constitutive' for to cognitive processes. In case the body/environment is thought to merely supply input to the brain and the brain sends out motor instructions, "the old Fodorian idea of perception and action as buffering central cognition would seem to survive relatively unscathed" (Kiverstein 2012, 743). Body enactivists, in contrast, reject a clear-cut causal relation between perception, action, and cognition all together. In this view, the body connects us with the world

and through repeated practice we acquire skills and develop abilities that determine how we perceive the world. The body enactivist

understands embodiment in terms of bodily skills we draw on all the time when we act unreflectively, and in virtue of which we can encounter situations that are meaningful. (752)

The challenge for the embodiment position, Kiverstein says, consists in showing “that body and world can be genuine parts of cognitive processes”, but, if successful, is due to “spell trouble for any view committed to the computer theory of mind” (741).

2.1 Body Conservativism

Malmkjær (2020, 55 ff.) develops a *theory of meaning for translation* based on Davidson’s (1986) “highly simplified and idealized proposal of what goes on” between a speaker, her audience, and an interpreter. Malmkjær suggests that each participant in this communication (hence also the translator/interpreter) has at any one moment in time a “prior theory” about the other communication partner, which they establish based on observable clues that are “so far available to him” (55). This prior theory is updated during the encounter to become a “passing theory” which takes into account adjustments due to the new utterances. This passing theory is constantly adapted in the current situation, to the extent that successful communication is possible if the passing theories of the communication participants converge “from time to time”. Citing Kandel (2018), Malmkjær (2020, 62) notes that “our mind is a set of processes carried out by the brain” where meaning emerges as a relationship between time, place and passing theories. Meaning, then, is unique and unrepeatable; it is “as fleeting as the moment in which it arises” (56). However, there may be coincidence and closeness of passing theories at any instance of linguistic interaction.

Malmkjær calls these “theories” – following Davidson – where “models” or “beliefs” might have been a better term. A theory is often understood as a system of ideas (aka concepts) intended to explain something based on rational thinking and general principles, thereby systematically linking the relationships between concepts that are supposed to explain the thing. It is, however, unclear whether and how “passing theories” are independent from the communication situation to be explained, and how the explaining concepts are rationally linked ad hoc, from moment to moment into a consistent system. As Malmkjær notes, these theories may be subliminal, they are “rarely made fully conscious to or even thought of by all the players” (2020, 55), which undermines a notion of “theory” even more.

More importantly, since at every moment there can be a large number of competing “passing theories”, she introduces the notion of “aesthetic attitude” which accounts for how a translator can select from a body of possible passing theories the one that is most relevant to guide successive action in the particular context:

translating a text to which one has adopted an aesthetic attitude is likely to be a creative endeavor that results in bringing something new to the world. (68)

She gives numerous examples for the effects of an “aesthetic attitude” (and the lack thereof) and the resulting creativity in translation products; however, none of this refers directly to embodiment or enaction.

Malmkjær sees a strong relation of her own theory with Relevance Theory (RT; Sperber and Wilson 1986, Gutt 2001; 2004; 2005) which posits that “humans recognize each other’s acts of ostension as [...] having some beliefs that they want to share” (Malmkjær 2020, 53). However, rather than “aesthetic attitude”, RT (Gutt 2000; 2004; 2005) suggests the “principle of relevance” as a trade-off between translation effort and translation effect as a yardstick to decide which sets of beliefs (or passing theories, in Malmkjær’s terms) should be pursued. While Malmkjær thus considers a purely mental phenomenon (“aesthetic attitude”) to be at the origin of translational effects, the notion of ‘effort’ in RT introduces some kind of bodily aspect into the belief selection process.

Alves and Vale (2009) make this bodily aspect explicit by operationalizing the notion of Translation Units (TUs) in empirical process data. For Alves and co-authors, TUs provide a means to measure translation effort, in terms of translation duration, number of revisions, and gazing activities etc. However, they endorse body conservatism when assuming that we (i.e., translators) experience our environment through mental representations “of affairs in a possible or actual world” which are conceptualized merely as input for the brain, the location in which translational meaning is produced (Szpak, Alves, Gonçalves 2022).

Also, Alves and Jakobsen (2020, 4) seem to take up Malmkjær’s idea of prior and passing theories. They maintain that “the meaning construed by the translator is the translator’s theory of what was on the mind of the source-text author” and the act of translation consists in rendering this theory into a target language. In contrast to Malmkjær, Alves and Jakobsen claim that translators construe representations of meaning which “is necessarily creative” (3) – which was only a possibility for Malmkjær – assuming that “we cannot know exactly what a person’s experienced meaning is”. This stipulates a phenomenal (rather than cognitive) characterization of meaning underlying the translator’s aesthetic attitude.

Similarly, Martín de León (2017, 121) posits that

embodied, embedded approaches view mental representations as dynamic internal support to meaning construction and translation and interpreting processes.

For Muñoz and Martín de León (2020, 61), “meaning happens in our heads, and only in our heads”, and the meaning “in the head” is a necessary prerequisite for translation. They suggest that body/environmental states merely supply inputs to the brain. Muñoz and Rojo López (2018, 62-8) suggest a stratificational, connectionist bottom-up model of the translating mind in which first visual or auditory language units are activated in the translator’s head. These visual or auditory language units successively activate lexical representations, then episodic and semantic knowledge is activated and integrated into the “situation prompted”, where

schemas and frames structure the knowledge in our minds and meaning emerges as an inferential process [...] resulting from the interaction between schematic, ad hoc knowledge structures and further cognitive or construal operations.

This position shares great similarity with the “computer theory of mind” (see Carl 2023b).

2.2 Body Functionalism

While body conservatism seems to be the dominant view in CTS, some authors have suggested versions of body functionalism. Baggio (2018), for instance, uses “in the head”, “in the mind”, and “in the brain” interchangeably. For him, “brain states are causally linked to states of the world” where anything located in the body or the environment, and thus external to the central nervous system, can make a causal contribution to cognitive processes. For Baggio the body and the world are external to the mind; both are hidden causes for sensory flows of information. Piccinini (2022, 5) defines such causal processes to be representational:

a neural structural representation is a state of a simulation of a target [e.g., the outside world], where a simulation is a system of states, homomorphic to their target, which can evolve to match the evolution of their target to some degree of approximation.

Another approach to body functionalism in translation is exemplified in ergonomic and workplace studies. There are a large number

of workplace studies that investigate when and how computer-based translation aides, such as CAT tools of Machine Translation (MT) can be deployed by translators in generating multilingual content (Ehrensberger-Dow, Delorme Benites, Lehr 2023; Ehrensberger-Dow, O'Brien 2015). While earlier suggestions, such as Martin Kay's (1997) *Proper Place of Men and Machines in Language Translation* may be considered instantiations of 'body conservatism', as here translation tools are thought to merely supply inputs to the brain, more recently the translator's brain is supposed to take the role of a controller while the tools/body enhances the translator's cognitive capacities - which was also anticipated in Kays seminal paper. Workplace-based research in translation studies has gained momentum due to advances in research tools and methods (Angelone, Ehrensberger-Dow, Massey 2019). These studies stress the importance of the translator-in-the-loop. Thus, Ehrensberger-Dow, Delorme Benites and Lehr (2023, 394) point out the causal role when translation

tools should be inserted where appropriate but that language professionals should be in the centre and control the flow of the translation process.

Besides translation tools, also emotions can be viewed as carriers of body functional states that serve specific adaptive purposes. According to some authors (e.g., Hubscher-Davidson) emotions play a crucial role in regulating translational behavior and responding to environmental stimuli. Hubscher-Davidson (2017, 9) defines emotions as embodied phenomena that involve changes in subjective experience, behavior, and peripheral physiology.

However, emotions, for her, do not seem to be constitutive in translation, as body enactivism would claim (see below). Hubscher-Davidson makes a distinction between "purely cognitive processes" and emotions/affect requesting that "the psychology of translation must also encompass the study of attitudes, personalities, and dispositions." (3) It has become apparent, she says, that cognition and emotion are not isolated entities "emotions influence the translator" (5) In this view, emotions are conceptualized as adaptive responses that serve specific functional roles, where emotion and cognition "interact in order to guide behaviour". (10) Emotions play a crucial role in influencing cognitive processes, such as attention, memory, decision-making, and problem-solving. In line with body functionalism, emotional experiences can impact the encoding and retrieval of information, affect the allocation of attentional resources, and influence the evaluation of stimuli and events.

Hubscher-Davidson (2017) traces studies on emotion in translation process research back to (Fraser 1996) who finds that translator's "levels of personal and emotional engagement with their work

seemed to impact on its quality” (Hubscher-Davidson 2017, 32). Subsequent research (such as Jääskeläinen 1999) suggests that “differences in translators’ work could be partly linked to affective and personality factors”, and that “translators’ levels of personal and emotional engagement with their work seemed to impact on its quality” (Hubscher-Davidson 2017, 32) Emotions, here, seem to merely inform the translating mind and impact translation effort: “negative emotions may increase processing effort while positive emotions may expand attention and creativity”.

Similarly, “positive affect seemed to influence creativity and negative affect seemed to improve accuracy” (33). Also decision-making in translation is, at least partly, impacted by emotions. The causal role of emotional intelligence for obtaining a translation job in the translation industry, as Hubscher-Davidson (2017, 34) points out, is documented in job announcements such as

The British Secret Intelligence Service (MI6) recruits language specialists for their translation work who can demonstrate ‘strong emotional intelligence’.

However, Hubscher-Davidson also alludes to emotion that may go beyond merely informing the brain about computational routes to be taken. Emotions may take over translational decisions when, for instance, she reports that

translators working in their L1 and translators working in their L2 are likely to process, and therefore regulate, emotional material differently, thus producing different results. (122)

Here, emotions have apparently more than just a functional role, they seem to be fundamental, constitutive for the translation results. But, as Kirchhoff and Kiverstein (2021) point out, the causal-constitutive boundary may not always be very clear.

Increasing evidence is being presented that supports top-down hierarchical predictive processing (Hohwy 2016), suggesting

that high-level (word) predictions inform low-level (phoneme) predictions [...] revealing dissociable neural signatures of syntactic, phonemic and semantic predictions. (Heilbron et al 2022, 2)

rather than the other way round. The view suggests that expected input is unsurprising, that only surprising input is informative, and that unsurprising input is likely not fully processed (Lundqvist et al 2022). However, surprise is an emotional response that is characterized by a sudden, unexpected novel or unforeseen event, stimulus, or situation. Surprise involves a temporary disruption of one’s cognitive

and emotional expectations, often leading to physiological changes and behavioral adjustments. While such considerations are compatible with body functionalism and a computer theory of mind, they also encourage body enactivism.

2.3 Body Enactivism

Enactivism is the view that “cognition is grounded in a pre-rational understanding of the world that is based on sensorimotor acquisition of real-life situations” (Engel et al. 2014, 219), where “the relation to the world can be only one rooting in practice, in acting, and practice [...] mediated through the body” (223).

For the body enactivist meaning emerges through interaction with the world and technology, rather than as a purely internal inferential process and manifests itself in direct (i.e., representationally unmediated) coupling between the translator and their translation environment.

Robinson (2023), for instance, takes an enactivist position on emotion. For Robinson feelings and emotions are part of minds and tools for thinking which are, he says, to a large extent embodied and embedded. They are constitutive – rather than merely causal – for acting within/collaborating with the environment. Affect, he says

is the glue that makes the world we cocreate with our environments cohere; and our access to that glue and that world/agent adherence/coherence is what makes all communication possible, intralingually, interlingually, and intersemiotically. (Robinson 2023, 86)

According to Robinson the translator’s awareness is her “ability to understand other people’s feelings and feeling-saturated thoughts”. The awareness of the translator’s own feelings and emotions with respect to the intersection and differences between cognitive environments of the source and target audience would, thus, lead to the selection of appropriate translations in which sensorimotor contingencies comprise the body and the environment, rather than representing it.

Another account of the constitutional role of human-environment interaction in translational cognition has been suggested in the PACTE competence model (PACTE 2003; Kuznik, Olalla-Soler 2018, even though they do not call it such), which lists the “Use of Instrumental Resources” as one of the core requirements – and therefore constitutional – for translation competence. Use of instrumental resources includes interaction with the environment, such as the ability to search the Internet, usage of collocation tools, translation memories, etc. as a constitutive part of translation competence. There is

a large body of literature on translator-technology interaction,¹ such as Machine Translation post-editing, the impact of CAT tools on the translation job, but also usage of dictionaries and other non-electronic reference materials in (pre-computerized) traditional environments. Authors sometimes take a causal, body functional and sometimes a constitutive, body enactivism position.

There has been a desire in CTS to investigate translation behavior and cognition in a real-world, ecologically valid setting (Mellinger, Hanson 2022), from a perspective that takes the translation environment into consideration. Underlying this view is the conviction that a full picture of translation and the translation process cannot be obtained in the lab (or in the head) only, without taking into account the environment in which professional translations emerge, hence that the brain, body and the environment are *constitutive* rather than merely causal for translation, as they are in a mutual dependency relation.

This view leads to an extended conception of the mind and a novel understanding of the location of meaning production. Borrowing the notion of “predictive encoding” (Hohwy 2016, see above) – which states that the mind selectively scans the environment to confirm its predictions thus to minimize surprise – Kirchhoff and Kiverstein (2019, 4804) suggest that the “boundary of the mind is relative and variable” and that

the mind is nested and multiscale sometimes extending beyond the individual agent to incorporate items located in the environment. The boundaries of the mind will coincide over time with the boundaries of the self-evidencing individual agent.

A crucial corollary of the “self-evidencing agent” is to minimize surprise, so as to remain in a fluent and stable exchange with the environment. However, this is just what electronic aides are supposed to do, as the self-evidencing interaction with the translation environment ensures that translation proceeds smoothly without unanticipated hurdles or surprise. Thus, Risku and Rogl (2020, 491) maintain that “changing the environmental or social circumstances can be seen as interventions to minds”. Important parts of the translation process, such as encyclopedic knowledge or translation of terms are provided by technological aids. Balashov (2020, 365) points out the complementary of humans and machines in this task, where:

1 The first prominent account is perhaps Martin Kay’s (1980) *Proper place of Man and Machine in Language Translation* <https://aclanthology.org/www.mt-archive.info/70/Kay-1980.pdf>.

the translator is not obligated to fully internalize the output of a CAT tool during a fuzzy match repair or fragment assembly [... rather] the translator can sign off on a morpho-syntactically coherent target language sentence whose exact technical meaning is beyond his grasp.

Production of meaning, in this view, is not (only) in the head of a translator but emerges as collaborative realization of affordances, in which

the required morpho-syntactic polishing can be performed in the absence of deep semantic knowledge; all one needs is knowledge of part-of speech identity of the relevant unfamiliar terms and their shallow semantic features such as animate vs. inanimate, solid vs. liquid, and the like. As a result, the translator's semantic obligations may be rather limited. (Balashov 2020, 365)

Here, construction of textual meaning is enacted in a collaboration, resulting from the interaction of the translator with the environment, which includes the translator, MT and CAT tools, among others. If meaning is a mental phenomenon, that is, meaning construction takes place where the mind is, then meaning may not be in the head only.

External resources form a part of an agent's mind when they are poised to play a part in the processes of active inference that keep surprise to a minimum over time (i.e., that minimise free energy). (Kirchhoff, Kiverstein 2019, 4807)

It is clear that the success story of CAT tools and usage of Machine Translation in the translation industry (and beyond) is grounded in the minimization of surprise (and higher productivity) with each new technological breakthrough over the past decades. If this is true, cat tools and MT are also part of the self-evidencing individuum that comprises of the brain, the body, and the environment.

3 The Free Energy Principle (FEP)

The Free Energy Principle (FEP) is a formal framework to model this agent-environment interaction. FEP is a formal framework that allows for different embodiment approaches. I will briefly describe some of the main ideas and how they might be applied to translation.

The FEP is a comprehensive account of our interaction with the world, developed within theoretical neuroscience to provide an explanation for embodied perception but used in many other domains. The FEP models "how we represent the world and come to sample it

adaptively” (Friston 2009), where the cognitive agent and its environment establish a circular relationship mediated by sensation and action. The FEP models the relation between the internal states of an agent (e.g., a cell, the brain, the mind) independent and separated from the external environmental states, but mediated through sensation and action, so-called Markov Blankets (MBs). It implies that an agent has never direct access to the environment, rather the environment is ‘hidden’ behind the senses (i.e., the MB), and the access is always ‘filtered’ through the agents’ input and output organs. In order to arrive at a flow state² in which the agent is in tune with the environment, she can either adjust her internal model based on the sensory input, and thus adapt her internal model in line with the observed evidence in the environment, or she can act on the world so as to modify the environment to better fit her prior expectations. In either case the average surprise (i.e., the free energy) will be minimized over larger amount of time which allows the agent to react smoothly, so that a maximum amount of her energy is bound in the completion of the task at hand, rather than in surprise or (unnecessary) distractions.

Free energy is the sum of prediction errors, which an agent seeks to minimize. This minimization can be an act of rational intervention: “To act rationally means to achieve a proficient engagement with the environment through prediction and error minimization” (Rolla 2021, 20). According to Rolla, rationality can be distributed, conscious, subliminal, representational or non-representational: “rational processes need not imply contentful cognition” (Rolla 2021, 20). Minimization of free energy could also be based on emotional response. FEP is thereby agnostic with respect to the nature of the assumed processes.

In order to arrive at - or to remain in - a state of low entropy, agents develop strategies, or so-called ‘action policies’:

an action policy is a sequence of actions - a path that takes the agent from its current sensory states to those it expects to occupy in the future. (Kirchhoff, Kiverstein 2021, 4807)

Action policies can be modelled through *Active Inference* (AIF) by reducing expected free energy which ensures that agents continue to occupy states with low surprise, on average and over time. In this sense, the FEP can provide a convenient ground on which a “complementary, integrative approach” (Alves, Jakobsen 2020, 547) might be established, laying the paradigmatic and epistemological foundations for future research in CTS (Carl 2023a), while at the same

² <https://positivepsychology.com/theory-psychology-flow/>

time bridging the gap to ecological-enactive theories that conceptualizes cognitions as brain-body-environment sensorimotor interaction (Kirchhoff, Kiverstein 2021; Kiverstein, Kirchhoff, Froese 2022).

3.1 FEP in Translation

FEP is also a suitable framework to model and explain translation processes, compatible with different approaches of embodiment (Carl 2023a). During their job, translators aim at maintaining a state of fluent translation production. A state of fluent translation is characterized by deep immersion, focused attention, and a sense of effortless concentration. It requires a balance between the translator's skills and the level of challenge, leading to a sense of complete engagement and absorption in the present moment.

When a translator is interrupted in her fluent translation production, for instance, because of an unknown term, an ST ambiguity that allows for several renderings in the TL, or an inappropriate shallow semantic features during post-editing (see above), etc., a translator may enter a state of surprise or hesitation, perhaps resulting in searching internal and/or in external resources. A translator may use electronic resources, search for expressions on the Internet, consult a colleague over the Internet, or even resort to a paper dictionary. She may also engage successive translation planning to ensure smooth continuation. This activity will adjust (or extend) the translator's internal model – cf. Malmkjær's posterior passing theory – which updates the translator's beliefs and expectation. However, in addition to updated passing theories, the active engagement with the environment is of central importance in FEP/AIF.

Rather than updating her model, a translator may also change the environment (i.e., the text) so that smooth translation production can continue. For instance, a post-editor who is engaged in revising the output of an MT system will (probably) doubt when stumbling over a semantic inconsistency and start researching the context to find out whether there could be a mistranslation, e.g., a lexical mismatch. If it turns out that the MT output was acceptable, the post-editor will probably adjust her internal model such that if a similar MT output occurs a second time, she will no more be as surprised as on the first occurrence since her predictions have now changed. However, if the expression was a mistranslation produced by the MT system, the translator would fix the error, without updating/changing her internal model or future predictions.

3.2 Boundaries of the Translating Mind

Both translators and post-editors remedy their internal prediction errors by making use of external resources. These resources are essential parts in the translation practice, albeit more so for post-editors than for a 'traditional' translator. Thus, Balashov (2020, 368) finds that

a contemporary translator is willing to transfer a lot more authority to the external extensions of his mind [and is] happy to let the computer do as much as is practically possible.

In particular, Interactive Machine Translation (IMT, Alabau et al. 2014) systems can adapt and improve their translation outputs at runtime during a translation session based on the input and guidance provided by human users. The interaction between IMT system and human translators allows for real-time input, feedback, and corrections during the translation process. This collaborative approach combines human translators with the efficiency of automated translation, and in combination enhances translation accuracy, linguistic proficiency, and efficiency.

That is, in a translator-computer-environment interaction distinct parts of the translation job are distributed over different parts of the combined system which jointly minimizes the translation errors. Here, the different parts mutually condition each other, together constituting one mental system. Kirchhoff and Kiverstein (2021, 4802) say:

The system that is self-evidencing is the whole adaptive agent in its coupling to its niche. This system is self-evidencing because it is a free-energy minimising system.

Any system, they say, that minimizes prediction errors will be, in the long run, self-evidencing, where self-evidencing "is equivalent to the agent maximising evidence for the hypothesis of its own continued existence in its niche" (4801).

In this view the (translating) mind, seen as a self-evidencing system, includes parts of the environment which help a translator "to maintain a reasonably tight grip on the shifting dynamics [that] partly defines the kind of agent he is" (4805).

In this context, meaning is actively generated by a self-evidencing agent based on the history of interaction with its environment. In this interaction, meaning is "brought forth by the agent through a history of engagement with an environment that is relevant to the agent" (Kiverstein, Kirchhoff, Froese 2022, 4).

For Searle (1983) the “problem of meaning” is how do we get from physical signals to semantics, and vice versa. The key to the problem of meaning is, according to Searle, to understand that the mind intentionally imposes the same conditions of satisfaction on physical expressions as the mental state has itself. The mind imposes Intentionality on external entities (such as sound or marks on a sheet of paper) “by intentionally [i.e., purposefully] conferring the conditions of satisfaction of the expressed psychological state upon the external physical entity” (27).

Meaning exists only where there is a distinction between the Intentional content and the form of its externalization [...]to ask for the meaning is to ask for an Intentional content that goes with the form of externalization. (Searle 1983, 28)

Forty years after Searle’s seminal work, FEP invites us to identify the boundary of the mind as MBs of the self-evidencing individual (Kirchhoff, Kiverstein 2021), at the boundaries of which meaning emerges. However, there may be many ways in which Intentionality may arise in a hybrid human-machine collaborative system and it may not always be obvious how to draw that line between the agent and the environment. The “questions about where to make the causal-constitutive cut remain [and may] lead us to reach a different conclusion about the boundaries of the cognitive system” (4803-4).

It may require us to treat some external element as part of the mind and to reconsider notions of Intentionality and representation.

4 Conclusion

This chapter builds on Kiverstein’s (2012) embodiment taxonomy, which distinguishes between body conservatism, body functionalism and body enactivism. According to Kiverstein, the first two notions of embodiment assume the mind to be a function of the brain. Body enactivism, in contrast, allows the mind to stretch into the environment, where the environment is a genuine part of cognitive/mental processes, and thus a part of the self-evidencing individual in a distributed brain-body-environment system.

Cognitive Translation Studies (CTS) has mainly endorsed a conservative notion of embodiment, in which bodily notions, such as emotions, translation effort, and external tools merely contribute to information processing in the brain. I develop a notion of embodiment and enaction in translation that acknowledges the interaction of the translator with its environment to be constitutive for translational cognition which is supported from computer-assisted translation and Machine Translation post-editing.

The Free Energy Principle (FEP) is a formal framework agnostic with respect to different embodiment positions that have been used to explain cognitive translation processes. In this chapter, I have tried to lay out how it can be used to model body enactivism and the extended mind hypothesis based on self-evidencing interaction with translation technology. However, instead of opposing one translation model against another, FEP/AIF provides a framework which can potentially unify different standpoints in CTS while acknowledging the importance of translator-environment interaction.

Bibliography

- Alabau, V. et al. (2014). "CASMACAT: A Computer-assisted Translation Workbench". *Proceedings of the 14th Conference of the European Chapter of the Association for Computational Linguistics*. Los Angeles: Association for Computational Linguistics, 25-8.
- Alves, F.; Jakobsen, A. (2020). "Grounding Cognitive Translation Studies: Goals, commitments and challenges". Jakobsen, J.; Alves, F. (eds), *The Routledge Handbook of Translation and Cognition*. New York: Routledge, 545-55.
- Alves, F.; Vale, D. (2009). "Probing the Unit of Translation in Time: Aspects of the Design and Development of a Web Application for Storing, Annotating, and Querying Translation Process Data". *Across Languages and Cultures*, 10(2), 251-73. <https://doi.org/10.1556/Acr.10.2009.2.5>.
- Angelone, E.; Ehrensberger-Dow, M.; Massey, G. (2019). *The Bloomsbury Companion to language industry studies*. Cambridge, MA: Bloomsbury Publishing.
- Baggio, G. (2018). *Meaning in the Brain*. Cambridge, MA: MIT Press.
- Balashov, Y. (2020). "The Translator's Extended Mind". *Minds & Machines*, 30, 349-83. <https://doi.org/10.1007/s11023-020-09536-5>.
- Carl, M. (2023a). "Empirical Translation Process Research: Past and Possible Future Perspectives". *Translation, Cognition and Behavior: Benjamins*. <https://arxiv.org/abs/2308.01368>.
- Carl, M. (2023b). "The Monitor Model and its Misconceptions: A Clarification". *American Translators Association Scholarly Monograph Series, XX, 2023*. John Benjamins. <https://arxiv.org/10.48550/ARXIV.2210.14367>.
- Chemero, A. (2010). *Radical Embodied Cognitive Science*. Cambridge, MA: MIT Press.
- Davidson, D. (1986). "A Nice Derangement of Epitaphs". Lepore, E. (ed.), *Truth and Interpretation: Perspectives on the Philosophy of Donald Davidson*. Blackwell, 433-46.
- Ehrensberger-Dow, M.; Benites, A.D.; Lehr, C. (2023). "A New Role for Translators and Trainers: Mt Literacy Consultants". *The Interpreter and Translator Trainer*.
- Ehrensberger-Dow, M.; O'Brien, S. (2015). "Ergonomics of the Translation Workplace: Potential for Cognitive Friction". *Translation Spaces*, 4(1), 98-118.
- Engel, D. et al. (2014). "Reading the Mind in the Eyes or reading between the lines? Theory of Mind predicts collective intelligence equally well online and face-to-face". *PLoS One*, 9(12), e115212. <https://doi.org/10.1371/journal.pone.0115212>.

- Fraser, J. (1996). "The Translator Investigated: Learning from Translation Process Analysis". *The Translator*, 2(1), 65-79.
- Friston, K. (2009). "The Free-energy Principle: A Rough Guide to the Brain?" *Trends in Cognitive Sciences*, 13(7), 293-301.
- Friston, K. (2010) "The Free-energy Principle: A Unified Brain Theory?". *Nature Reviews Neuroscience*, 11(2), 27.
- Friston, K.; Fitzgerald, T.; Rigoli, F.; Schwartenbeck, P.; Pezzulo, G. (2017). "Active Inference: A Process Theory". *Neural Comput.*, 29(1), 1-49.
- Gallagher, S. (2017). *Enactivist Interventions: Rethinking the Mind*. Oxford: Oxford Academic.
- Gutt, E.A. (1991-2000). *Translation and Relevance: Cognition and Context*. Manchester: St. Jerome.
- Gutt, E.A. (2004). "Applications of Relevance Theory to Translation – a Concise Overview". <https://doi.org/10.13140/RG.2.2.33067.80162>.
- Gutt, E.A. (2005). "On the Significance of the Cognitive Core of Translation". *The Translator*, 11(1), 25-49.
- Heilbron, M. et al. (2022). "A Hierarchy of Linguistic Predictions During Natural Language Comprehension". *Proc Natl Acad Sci U S A*, 119(32), e2201968119. <https://doi.org/10.1073/pnas.2201968119>.
- Hohwy, J. (2016). "The Self-evidencing Brain". *Nous*, 50(2), 259-85.
- Hubscher-Davidson, S. (2017). *Translation and Emotion: A Psychological Perspective*. Milton Park: Taylor & Francis Group.
- Jääskeläinen, R. (1999). *Tapping the Process: An Explorative Study of the Cognitive and Affective Factors Involved in Translating*. Joensuu: University of Joensuu.
- Kandel, E.R. (2018). *The Disordered Mind: What Unusual Brains Tell Us About Ourselves*. New York: Farrar, Strauss and Giroux.
- Kay, M. (1997). "The Proper Place of Men and Machines in Language Translation". *Machine Translation*, 12(1/2), 3-23. <http://www.jstor.org/stable/40009025>.
- Kirchhoff, M.D.; Kiverstein, J. (2021). "How to Determine the Boundaries of the Mind: A Markov Blanket Proposal". *Synthese*, 198, 4791-810. <https://doi.org/10.1007/s11229-019-02370-y>.
- Kiverstein, J.; Kirchhoff, M.D.; Froese, T. (2022). "The Problem of Meaning: The Free Energy Principle and Artificial Agency". *Frontiers in Neurorobotics*, 16(844773). <https://doi.org/10.3389/fnbot.2022.844773>.
- Kiverstein, J. (2012). "The Meaning of Embodiment". *Topics in Cognitive Science*, 4, 740-58. <https://doi.org/10.1111/j.1756-8765.2012.01219.x>.
- Krings, H.P. (1986). *Was in den Köpfen von Übersetzern vorgeht: eine empirische Untersuchung zur Struktur des Übersetzungsprozesses an fortgeschrittenen Französischlernern*. Tübingen: Gunter Narr Verlag.
- Kuznik, A.; Olalla-Soler, C. (2018). "Results of PACTE Group's Experimental Research on Translation Competence Acquisition. The Acquisition of the Instrumental Sub-Competence". *Across Languages and Cultures*, 19(1), 19-51. <https://doi.org/10.1556/084.2018.19.1.2>.
- Lundqvist, M. et al. (2022). "Reduced Variability of Bursting Activity During Working Memory". *Scientific Reports*, 15050. <https://doi.org/10.1038/s41598-022-18577-y>.
- Malmkjær, K. (2020). *Translation and Creativity*. New York: Routledge.
- Martín de León, C. (2017). "Mental Representations". Schwieter, J.W.; Ferreira, A. (eds), *The Handbook of Translation and Cognition*. New York: Wiley, 106-27.

- Mellinger, C.D.; Hanson, T.A. (2022). "Considerations of Ecological Validity in Cognitive Translation and Interpreting Studies". *Translation, Cognition & Behavior*, 5(1), 1-26. <https://doi.org/10.1075/tcb.00061.me1>.
- Muñoz, R.; Rojo López, A.M. (2018). "Meaning". *The Routledge Handbook of Translation and Culture*. New York: Routledge, 61-78.
- Muñoz, R. (2010). "On paradigms and Cognitive Translatology". Shreve, G.M.; Angelone, E. (eds), *Translation and Cognition*. Amsterdam: John Benjamins, 169-87. <https://doi.org/10.1075/ata.xv.10mun>.
- Muñoz, R. (2017). "Looking Toward the Future of Cognitive Translation Studies". Schwieter, J.W.; Ferreira, A. (eds), *The Handbook of Translation and Cognition*. Hoboken: Blackwell, 555-73.
- Muñoz, R.; Martín de León, C. (2020). "Translation and Cognitive Science". *The Routledge Handbook of Translation and Cognition*. New York: Routledge.
- O'Brien, S. (2017). "Machine Translation and Cognition". Schwieter, J.W.; Ferreira, A. (eds), *The Handbook of Translation and Cognition*. <https://doi.org/10.1002/9781119241485.ch17>.
- PACTE. (2003). "Building a Translation Competence Model". In F. Alves (Ed.), *Triangulating Translation: Perspectives in Process Oriented Research*, 43-66. John Benjamins. <https://doi.org/10.1075/btl.45.06pac>.
- Parr, T.; Pezzulo, G.; Friston, K.J. (2022). *Active Inference and the Free Energy Principle*. Cambridge, MA: MIT Press. <https://doi.org/10.7551/mitpress/12441.001.0001>.
- Pernu, T.K. (2017). "The Five Marks of the Mental". *Frontiers in Psychology*, 8. <https://doi.org/10.3389/fpsyg.2017.01084>.
- Piccinini, G. (2022). "Situating Neural Representations: Solving the Problems of Content". *Frontiers in Neurorobotics*, 16(846979). <https://doi.org/10.3389/fnbot.2022.846979>.
- Risku, H. (2012). "Cognitive Approaches to Translation". Chapelle, C. (ed.), *The Encyclopedia of Applied Linguistics*. London: Blackwell, 675-84.
- Risku, H.; Rogl, R. (2020). "Translation and Situated, Embodied, Distributed, Embedded and Extended Cognition". Alves, F.; Jakobsen, A.L. (eds), *The Routledge Handbook of Translation and Cognition*. New York: Routledge, 478-99.
- Robinson, D. (2023). *Questions for Translation Studies*. New York: Routledge.
- Rolla, G. (2021). "Reconceiving Rationality: Situating Rationality into Radically Enactive Cognition". *Synthese*, 198(03). <https://doi.org/10.1007/s11229-019-02362-y>.
- Searle, J.R. (1983). *Intentionality: An Essay in the Philosophy of Mind*. New York: Cambridge University Press.
- Sperber, D.; Wilson, D. (1986-95). *Relevance: Communication and Cognition*. Oxford: Blackwell.
- Szpak, K.; Alves, F.; Gonçalves, J.L.V.R. (2022). "Revisiting the concept of representation in translation process research: reflections from contemporary cognitive science". Presentation at EST, 314. <https://www.hf.uio.no/ilos/english/research/news-and-events/events/conferences/2022/est22/program/est22-oslo-abstract-booklet/est22-abstract-booklet.pdf>.