

Intersemiotic Translation, Cognitive Artefact, and Creativity

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Abstract: Intersemiotic translation (IT) can be described as a cognitive artefact designed as a predictive, generative, and metasemiotic tool that distributes artistic creativity. Cognitive artefacts have a huge variety of forms and are manipulated in many different ways and domains. As a projective augmented intelligence technique, IT works as a predictive tool, anticipating new, and surprising patterns of semiotic events and processes, keeping under control the emergence of new patterns. At the same time, it works as a generative model, providing new, unexpected, surprising data in the target-system, and affording competing results which allow the system to generate candidate instances. As a metasemiotic tool, IT creates a metalevel semiotic process, a sign-action which stands for the action of a sign. It creates an 'experimental laboratory' for performing semiotic experiments. IT submits semiotic systems to unusual conditions and provides a scenario for observing the emergence of new and surprising semiotic behaviour as a result. We explore these ideas taking advantage of two examples of ITs to theatrical dance: (1) from one-point visual perspective to classical ballet and (2) from John Cage's protocols of music indeterminacy to Merce Cunningham's choreographic composition.

Keywords: *intersemiotic translation, cognitive artefact, creativity, C. S. Peirce.*

ARTISTS ARE COGNITIVE CYBORGS

It is well known that many experimental artists who have creatively transformed their fields dedicated themselves to the intersemiotic translation (IT) of methods and aesthetic procedures from one sign system into another—Gertrude Stein translated Cézanne's and Picasso's proto-cubist and cubist approaches into literature (Perloff; Steiner); Kandinsky translated Arnold Schoenberg's methods into painting (Weiss); Morton Feldman translated abstract expressionism's formal procedures into music (Kissane); Paul Klee translated polyphony's music structures into painting (Verdi); Augusto de Campos translated Anton Webern and *Klangfarbenmelodie* models into concrete poetry (Cluver 1981). IT, here, is a notion close to 'adaptation' and refers to a creative process that involves transformation of signs. Our thesis here is that many periods of artistic creativity depend crucially on the translation of artefacts (materials, procedures, methods...) between different systems. In these cases, creative artists have their creative activity augmented by these ITs. ITs can be seen as 'implants' on 'cognitive cyborgs'.

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This is a new approach in the domain of intermediality and interart studies that brings together premises from Peircean semiotics and distributed cognition.

For Clark (2003, 3), humans are natural-born cyborgs, symbionts ‘whose minds and selves are spread across biological brain and nonbiological circuitry’. This thesis is related to our ability to extend cognition through non-biological devices, merging our cognitive activities with the operation of cognitive artefacts and creating an external and distributed cognitive system (Davies and Michaelian 2016). Not as a metaphor, ‘mind is just less and less in the head!’ (Clark 2003, 4), or mind is ‘out of our heads’ (Wheeler 193; Noë). Humans couple bodies with a paraphernalia of tools in order to augment perceptual, motor and cognitive competencies. Cognitive artefacts are a constitutive part of our cognitive lives: we are able to alter conscious states and attention by using pharmacological drugs; we ‘freeze’ reasoning and communicate it through the use of alphabets and other notation systems; and we organize, compare, and calculate the world through numbers, graphs, and diagrams. Various tools such as pen and paper, calculators, calendars, maps, notations, models, computers, shopping lists, traffic signals, measurement units, etc. are considered non-biological elements of a cognitive system (Hutchins 1995a, 2011).¹ Finally, the most impactful cognitive artefact that shapes human cognition is language: a deeply ingrained scaffolding device that radically augments what our cognitive systems can achieve in terms of categorization, memory, inference, learning, attention, as well as in building social relations and institutions (Clark 2006). These cognitive artefacts shape cognition: when we alter the constitution of our material environments of artefacts and the practices they afford, we can open new cognitive (and/or semiotic) niches (Clark 1998, 2006; Hoffmeyer; Magnani; Sinha), giving rise to new patterns of semiotic activity which in turn further modify the material environments themselves in a cumulative and ongoing process of niche construction (Laland, Odling-Smee, and Feldman). Humans are cognitive niche builders, extending the mind into the space to think more efficiently.

If this thesis is correct, and human cognitive achievements are highly dependent on the use of cognitive artefacts, what about artistic creativity? Distributed cognition and situated problem-solving traditions have described examples of the use of external tools in different domains (Bender and Beller; Bjørndahl et al.; Kirsh; Zhang and Norman; Zhang and Wang). But how is artistic creativity dependent on the exploration of cognitive artefacts? According to the premises indicated above, artists also rely on cognitive extensions, and different kinds of semiotic resources are cognitive artefacts that distribute cognitive activity. Furthermore, and as emphasized in the literature on intermedial relations, a number of creative artists rely on explicit cross-influence between different semiotic systems, in cases variously described as adaptation, ekphrasis, transmediation, or intersemiotic transposition (see Cluver 2006; Gronau, von Hartz, and Hochleicher; Vergo). We defend here the idea that IT is a cognitive artefact that scaffolds creativity in arts in different time scales. This implies that an artefact is not necessarily a physical thing or object. Procedures, methods, and techniques are also seen as artefacts: they are also constructed, adjusted, and perfected, and they also shape cognitive activities. Furthermore, following the premises of embodied-situated cognition, procedures, methods, and techniques are dependent and derived from situated manipulation of material things. That is, any procedure or technique is a

generalization of operations performed with physical objects, representational systems, and so on. We explore the idea of IT as a cognitive artefact taking advantage of two examples in dance: (1) translation of one-point visual perspective to classical ballet and (2) translation of random procedures from Cage's music to Cunningham's dance. But first we should clarify and develop our thesis by examining (1) what is artistic creativity? and (2) what is IT?

WHAT IS CREATIVITY?

'Creative artist' and 'artistic creativity' are terms of ordinary discourse that are used in unsystematic ways. We will partly base the development of our argument on Margaret Boden's ideas on creativity. Boden defines creativity as 'the ability to come up with ideas or artefacts that are new, surprising, and valuable'. "Ideas," here, includes concepts, poems, musical compositions, scientific theories, cooking recipes, choreography, jokes... and so on, and on. "Artifacts" include paintings, sculpture, steam engines, vacuum cleaners, pottery, origami, penny whistles...and you can name many more' (Boden 2010, 29). According to Boden (2010), one must distinguish three types of creativity: combinatorial, exploratory, and transformational. The first type (combinatorial creativity) is related to the emergence of ideas or artefacts through combinatorial processes of already known ideas or artefacts. The second (exploratory creativity) is the exploration of conceptual spaces, which are 'structured styles of thought' (Boden 2010, 32), and include 'ways of writing prose or poetry; styles of sculpture, painting or music; theories in chemistry or biology; haute couture or choreography; [...] summarizing any disciplined mode of thinking that is familiar (and valid) to a certain social group' (Boden 2010, 32). 'Ideas' are possible or conceivable in certain conceptual spaces. In exploratory creativity, possibilities are investigated and explored, without modification of the 'structure of thoughts'. The third type (transformational creativity) 'involves some transformation into one, or more, of the (relatively fundamental) dimensions that define the specific conceptual space' (Boden 2010, 29). A conceptual space is established through 'a set of constraints, which allows the generation of structures within this space [...]. If one or more of these constraints is changed (or abandoned), space is transformed. Ideas that were previously impossible (relating to the original conceptual space) become conceivable' (Boden 1999, 352). More rare, with greater 'cognitive cost', the transformational creativity is related to the emergence of new scientific and artistic paradigms. We are especially interested here in this type of creativity, and in its relation to external artefacts and materials (e.g., notations, protocols of execution, physical and mechanical properties of the instruments).

In our usage here, two complementations must be made to Boden's account: a further specification of what 'surprise' is, and a specific understanding of 'conceptual spaces' under the context of distributed cognition: There is, on Boden's three criteria of creativity (new, surprising, and valuable), a remarkable difficulty in defining 'surprise'. If 'new' is a statistical measure, and 'valid' is a socio-cultural effect related to the institutional nature of an idea, the notion of 'surprise' seems to oscillate between cognitive, phenomenological and historical perspectives, although the author does not distinguish between them. For C. S. Peirce,² 'surprise' is a phenomenon that has a double character: 'active' and 'passive'. An active surprise, or the active character

of a surprise, is the result of a ‘conflict’ with some expectation, of resistance with some known and accepted fact. It is an experience of conflict with a *habit*, a stable pattern of action (Atã and Queiroz 2016b). A habit is also described as a ‘pattern of constraints’ and has the logical form of a ‘conditional proposition’, stating that some facts would happen under certain conditions (EP 2.388). A habit is a ‘rule of action’ (CP 5.397, CP 2.643), a disposition to act in certain ways under certain circumstances, especially when the agent is stimulated or guided by certain motives (CP 5.480). In any case, for Peirce, surprise is an experience of resistance to a habit. A passive surprise is characterized more simply by ‘Something unexpected happens!’. A conflict with an expectation characterizes the commitment of a prediction created by a habit. Reactive experience with an unexpected event, typical of a more passive surprise, is also based on the stability of certain patterns of action. There is, in Peirce’s cognitive semiotics, a close correlation between surprise and creativity,³ suggesting that creative forms of reasoning depend on surprising phenomena.

Boden’s approach is consistent with internalist paradigms in cognitive science that regard cognition as the processing of internal, discrete, and intentional units of information and in which the role of context and external tools is secondary. As we saw, in opposition to such paradigms, the *distributed cognition* thesis has questioned the legitimacy of skin and skull to serve as criteria for the demarcation of the boundaries between mind and the world. This approach stresses that the capacities of mind are shaped by non-biological tools for thinking and that decisive stages of cognitive processing can happen externally to the brain. In a context of distributed cognition and embodied-situated cognitive science in general, the notion of ‘conceptual space’ needs to be reconceived and redescribed as an embodied-situated and distributed system. That is, its ‘structured styles of thought’ are embodied and situated in cognitive artefacts, and distributed in systems of various artefacts and agents.

We take, thus, ‘creativity’ to result from combinatory, exploratory, and transformational processes on embodied-situated and distributed conceptual spaces whose results are ‘new, surprising, and valuable’. These processes are dependent on cognitive augmentation, in the sense of Clark’s cognitive cyborgs. One of the cognitive artefacts that is frequently used as an augmentation device for scaffolding creativity in arts is IT. We give a description of this in the next section.

INTERSEMIOTIC TRANSLATION AS SEMIOSIS—A PEIRCEAN SEMIOTIC APPROACH

IT was defined by Roman Jakobson (114) as a ‘transmutation of signs’—‘an interpretation of verbal signs by means of signs of nonverbal sign systems’. After Jakobson’s definition, the term became broader and now it designates relations between systems of different natures, and it is not restricted to the interpretation of verbal signs (Queiroz and Aguiar). Consequently, this process is observed in several semiotic phenomena, including literature, cinema, comics, poetry, dance, music, theatre, sculpture, painting, video, and so on. In this sense, the concept bears similarities to others like adaptation, ekphrasis, and transmediation.

Our view of IT implies an understanding of translation as not centred around *referentiality*. That is, what we take to be more decisive for identifying IT is stable

communication of semiotic habits (patterns and constraints) between source and target signs, rather than communication of content or of form-content articulations or links. The act of translation is akin to a negotiation towards the achievement of *some form of semiotic stability* throughout the transformation of a sign. Reference is but one kind of possible semiotic stability to constrain the act of translation. In Translation Studies, our perspective can be linked to the view of translation as interpretation (Campos; Gorić; Jakobson; Petrilli).⁴ More generally, our perspective comes from a philosophical standpoint developed across Peircean Semiotics and Philosophy of Cognitive Science: the notion that the central characteristic of semiosis/cognition is not the referentiality of informational units of representation, but rather complex and dynamic *sign-action*, or *semiosis*. IT is an intersemiotic communication of sign behaviours, dispositions, and internal constraints. The question ‘what is intersemiotic translation?’ is thus related to the question ‘what is semiosis?’.

Semiosis is a concept that describes the most fundamental relations involved in processes of meaning and cognition, as opposed to reactive processes (EP 2:646). Reactive processes are any ‘non-mental’ processes in the physical and chemical world which are governed by dyadic relations. In contrast, semiosis is, according to several authors (see Ransdell), the most general description of the internal structure of mind processes. One important premise that must be clarified before going on is related to the broad concept of ‘mind’ in Peirce’s philosophy. Whenever we refer here to a ‘mind’, a ‘cognitive system’, or an ‘interpreter’, we do not necessarily mean a person or an individual. It is not the case that only conscious beings can be interpreters in a Peircean framework (see Queiroz et al.). It is useful here to refer to the notion of cognitive system as conceived by distributed cognition. Distributed cognition, situated cognition, and the ‘E4’ paradigm (Clark 2010; Clark and Chalmers; Hutchins 1995a,b; Kirsh; Menary; Noë) attacked cognitive internalism, claiming that the description of cognitive processes as brain-bound information processing misses the point of how cognitive processes actually happen ‘in the wild’ (Hutchins 1995a). A conception of cognition should also acknowledge and integrate perceptual and motor systems, non-biological material inside and outside of the body, and the social, multi-agent, contexts in which cognition happens. For distributed cognition, everyday objects, such as shopping lists, computers, pen and paper, maps, charts and diagrams, and so on, are cognitive artefacts (Hutchins 1999) that aid, support, enhance, or improve cognition. Furthermore, ‘cognitive systems’ are broad notions that refer to how several agents coordinate their cognition through shared systems of cognitive artefacts. A cognitive system is seen as ‘distributed’ in sociotechnical systems.

Keeping that in mind, according to Peirce, any description of semiosis should necessarily treat it as a relation constituted by three irreducibly connected terms—sign, object, and interpretant (S-O-I, in short), which are its minimal constitutive elements (CP 5.484, EP 2:171) (Figure 1). S in S-O-I is the entity, structure, or process being employed by a cognitive system to stand for something else. O in S-O-I is something else that the sign *stands for*. In the cases that we are interested in here, this object should be understood not as a substance, property, or thing in itself, but as another sign or a semiotic process. I in S-O-I is an effect produced in a (‘distributed’) cognitive system by the use of S as regulated by O. Semiosis in the cases that interests us here is thus an

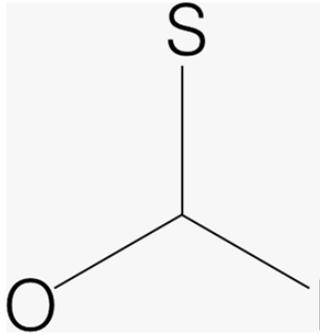


Figure 1. The three irreducibly connected terms: sign–object–interpretant (S-O-I).

irreducible process through which a constraining factor (O) acts on cognitive behaviour (I) because of the mediation of a certain entity (or group of entities) or process (S).

It is relevant that semiosis is characterized as triadically irreducible. In an irreducible triad, what brings together all the terms of the relational complex cannot be any sum of dyadic correlations between the terms (Brunning; Burch). The relation between source and target is traditionally treated as a dyadic relation, either in Translation Studies or in Intermediality Studies. By applying Peirce’s model of semiosis, the phenomenon of translation is observed as essentially triadic, interpreter and context-dependent. Any relation between a sign and its object depends on an interpretant. A consequence of this characterization is that whenever we are describing a meaning relation we have to make a reference to *who* is this relation meaningful for. The pronoun ‘who’, here, is not to refer necessarily to psychological agents, but to any kind of cognitive, interpretative, system (Queiroz et al.).

The effect of the sign on the cognitive system is the interpretant. It is only in simultaneity with an interpretant that any entity can be said to be a sign and possess an object. Another consequence of the formal definition of semiosis as a triadic relation is that sign, object, and interpretant are viewed as functional roles (Savan 43). These roles can be taken by virtually any entity or process, provided that the interpretant is an effect produced on a cognitive system. Furthermore, a same entity or process can take different roles in different meaning relations: an interpretant in a given S-O-I relation can immediately take the role of a sign in another S-O-I relation, for example. Semiotic relations are not isolated, but connected in temporally and spatially distributed chains and webs.

What about IT? If translation is a semiotic process, the description above also corresponds to a minimal formal description of what a translation is. In an IT, the semiotic relation S-O-I describes how a translation source is translated into a different semiotic system, resulting in a translation target. There are two possible ways of mapping a translation source and a translation target to the S-O-I triad (Aguiar and Queiroz, Queiroz and Aguiar): either the source is the sign (S) and the target is the interpretant (I) (model 1, see Figure 2), or the source is the object (O) and the target is the sign (S) (model 2, see Figure 3):

What are the implications of modelling an IT through model 1 or model 2? The two models are not two different types of IT, but show different aspects of a same phenomenon. Model 1 puts the translation source in the functional role of sign, and

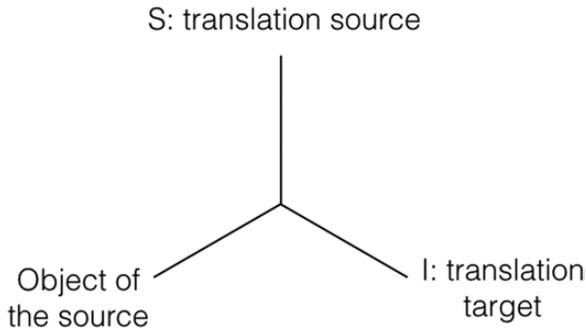


Figure 2. Model 1 of intersemiotic translation. In this case, the translation source is a sign, which mediates an object so as to determine the translation target as an effect. Note that this model graphically represents the object of the source, but not the effect of the target on its interpreters. Model 1 describes how, through a translation source, a certain pattern of constraints acts on a cognitive system so as to produce a translation target. The translation target is determined by the object of the source through the mediation of the translation source (I is determined by O through S).

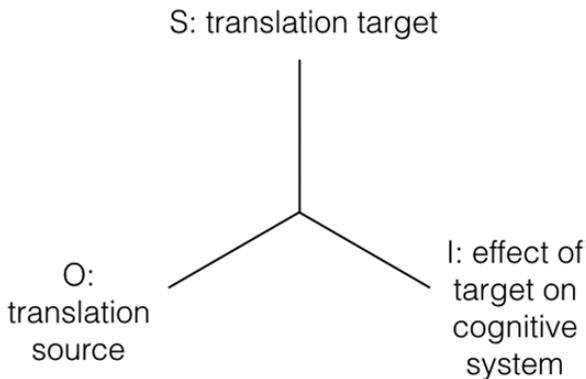


Figure 3. Model 2 of intersemiotic translation. In this case, the sign is the translation target, which mediates a translation source (viewed not necessarily as a 'substance', but as another semiotic process), so as to determine an effect on a cognitive system. Note that this model shows directly the translation source, but does not show directly the object of the source. This model represents graphically the effect of the target on a cognitive system as determined by the translation source through mediation of the translation target.

includes the object of the translation source in the model. It shows how the object of the translation source is co-dependent on the translation target: different ITs of a same source will stress, unveil, and/or construe different semiotic objects. Also, model 1 puts the target semiotic system (e.g., dance) in the functional role of a *cognitive* system. Model 2 puts the translation target in the functional role of sign, and includes the interpretants of the target in the model. The object of the triad is the translation source. In this model, we have the notion that a translation target stands for a translation source. This S-O connection, is, of course, dependent on interpretative effects being produced in a cognitive system. An obvious example of a cognitive system is an audience. Thus,

model 2 captures the notion that a work is perceived by an audience as a translation of another work. However, the interpreter cognitive system does not have to be an audience. We will explore such a case in the section below.

HOW DOES INTERSEMIOTIC TRANSLATION WORK?

We are interested in how IT as a cognitive artefact is used to scaffold creativity in dance. We will examine models 1 and 2 as semiotic processes involved in the creation of artworks. In this case, the functional role of the interpretant is not related to audiences, but to the creative process. We remind the reader, again, that the ‘interpreter’ in this case is not necessarily a individual psychological agent. The *loci* of interpretants in the ITs we are interested in here are distributed cognitive systems that create new artworks. How does such a distributed cognitive system use IT to scaffold creative processes? Our argument in this section is that models 1 and 2 above, when applied to artistic creation, describe, respectively, how IT functions both as an anticipatory and as a generative tool.

How can a cognitive system break away from previously established and structured styles of thought? How to navigate a novel and a yet unstructured space of creative possibilities so as to produce something recognizably valuable—as opposed to, say, gratuitous change? It is in the context of such challenges that IT is often used as a thinking-tool. IT scaffolds creativity by taking advantage of recognized differences between semiotic systems: if a source-system is part of a conceptual space structured differently than the conceptual space of the target-system, the influence of the source-system on the target-system can generate novelty (difference) in the latter. Furthermore, because the source-system has a structure with at least some degree of internal coherence, it is easier to produce novelty that is non-gratuitous, potentially recognizable as aesthetically valuable. We characterize the action of IT in scaffolding creativity as anticipatory and generative.

Intersemiotic translation as an anticipatory artefact

Cognitive systems use anticipatory, predictive models to direct action. This is an ubiquitous operation involved whenever an agent does something expecting something else to happen (using a door handle to open a door and enter your house is a trivial example of an anticipatory system in action). Examples of anticipatory tools used to organize action include schedules, planners, maps, blueprints, norms of etiquette, organizational diagrams and fluxograms, and so on. All of these tools reduce (or at least attempt to reduce) the number of possible choices a cognitive system will face in the future (by consulting a map to navigate to the other side of town, I know that I should avoid making any turns until the end of a certain avenue, by consulting my schedule, I know that today I should prioritize a certain work assignment instead of another). A conceptual space can be seen as a set of constraints that simplify the costs of cognitive activity for creators: artists do not have to start from scratch, they anticipate and simplify their creative process by reasoning in terms of already structured styles, conventions, canonical references, and so on. When a conceptual space is being transformed, a creative cognitive system is faced with unexpected creative and interpretative situations. IT plays an anticipatory role in reducing the difficulty of choice in these situations. In this case, the translation source is being used as predictive model, a ‘map’ that tells the creative cognitive system how to navigate through unfamiliar territory, by reducing

the cost of choices being made. This corresponds to viewing the translation source occupying the functional position of the sign, as according to model 1. In this case, the sign is a predictive model (see [Figure 4](#)).

Intersemiotic translation as a generative artefact

One of the functions of IT explored by creative artists is to take advantage of the semiotic difference between source and target to generate competing and otherwise unprompted creative opportunities in the target-system. During the creative process in an IT, a transformation in the target semiotic system leads to a cascade of further transformations in that system. The regulatory principles (the ‘structure’ of thinking) that used to regulate a conceptual space interact, change, or are partly abandoned, in favour of a different set of regulatory principles, which are being developed from the translation source. The translation source, in this case, functions as a generative seed that is being brought to act on a target semiotic system. Any translation choice that a creative cognitive system makes that establishes a transformation in a target conceptual space is a choice understood in reference to this generative seed. In this case, a transformation in a conceptual space occupies the functional role of sign, while the translation source occupies the functional role of object. The interpretant that they cause and in virtue of which they are brought together is the notion (to be realized in the future) of a new conceptual space (see [Figure 5](#)).

Intersemiotic translation as a metasemiotic artefact

We have previously stated that a translation source should not be viewed as a ‘substance’, but as a semiotic process. This is a reframing of the understanding of what an IT

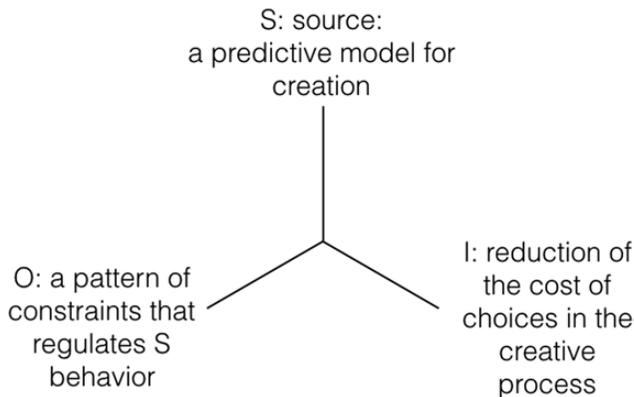


Figure 4. Intersemiotic translation as an anticipatory artefact. The translation source is in the functional position of the sign, and works as a predictive model for artistic creation. The locus of the interpretant is not the translation target itself, but the creative process that in the future will result in the translation target. The interpretant constrains this creative process, in the form of reduction in the cost of choices for the distributed cognitive system responsible for the creative process. The object is what the translation source is perceived to be ‘about’. Notice that S-O-I irreducibility entails that different creative processes (I) may reveal different objects for a same source.

translates. Whenever it is said that a media product or an artwork is translated, we have to take into account that in order to be translated, this media product or artwork has already been interpreted, that is, it has already determined effects on an interpreting system. Although Jakobson talks about a ‘transmutation of signs’, a more precise way to phrase it would be a transmutation of semiosis (action of a sign). The target is a triadic relation ($S^2O^2I^2$) and the source another triadic relation ($S^1O^1I^1$) (Figure 6). It is not another sign, but a triadic relation. This distinction (sign *versus* semiosis) is important because it emphasizes the processualist role of this cognitive artefact.

IT thus creates a metalevel semiotic process, a *sign-action which stands for the action of a sign*. A metasemiotic process (meta-semiosis) allows systematic inspection and criticism of semiosis. In this sense, IT can be described as a process designed to investigate semiosis. By using a target-system of signs, intersemiotic translators can investigate (inspect and evaluate) how to interpret a translation source. In this case, IT is a cognitive artefact with an epistemic function to improve understanding about the translation source, its material properties, and system of signs, and about the translation process itself.

How does this metasemiotic operation happen? We can metaphorically compare an IT to an ‘experimental laboratory’ (Atã and Queiroz 2016a) that allows semiotic experiments to be performed. Translators can generate and evaluate different hypotheses on how to transpose interpretative effects across semiotic systems, subjecting semioses to unusual conditions and observing the results.

TWO CASES OF INTERSEMIOTIC TRANSLATION TO DANCE

From one-point visual perspective to classical ballet

What is today known as classical ballet is related to the construction of practices and goals that structure the semiotic behaviour of agents (dancers, choreographers,

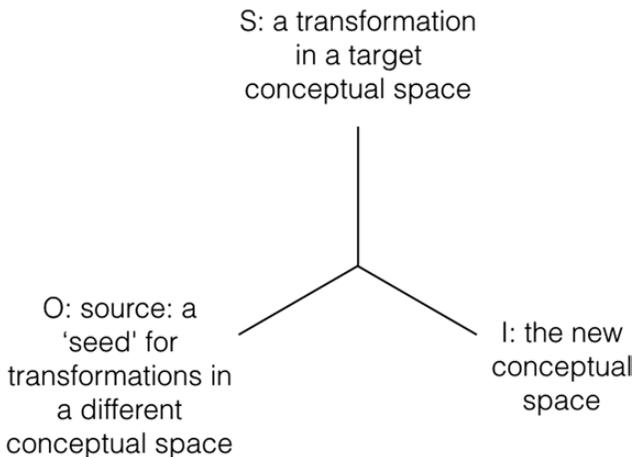


Figure 5. Intersemiotic translation as a generative tool. Because of the semiotic relation depicted, any transformation in a target conceptual space is taken to be a sign of a translation source. This intersemiotic relation between source and target is used to effect further transformations that (potentially, in the future) lead to a different conceptual space.

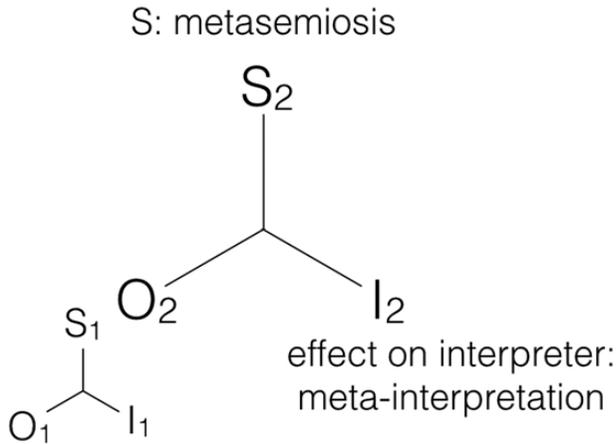


Figure 6. Intersemiotic translation as a metasemiotic artefact. Metainterpretation (I) is determined by S1-O1-I1 (source-sign) in relation to S2-O2-I2 (target-sign).

audience). One vector of this ‘conceptual space’ construction process is the production and introduction of cognitive artefacts developed in different domains. One important example is related to the transformation of theatres by the influence of one-point visual perspective (Crabtree and Beudert). In its origins in European courts, ballets were traditionally performed in palaces or parks, there were no elevated stages or proscenium arches, and the audience occupied seats arranged in tiers and viewed the spectacle from above (Homans 10). This positioning of dancers in relation to the audience afforded geometric patterns of dancers’ displacement in the performance space (see Figure 7).

The historical development of classical ballet saw a transition from these performance spaces to proscenium arch stages as we typically know them. This transition corresponded to a change in the relative positioning between dancers and audience and a different set of affordances constraining the performance space. This set of affordances has strong ties to bi-dimensional representations. The development of the Italian theatres during the Renaissance in Italy was directly influenced by visual perspective (see Breton), a technique developed by Filippo Brunelleschi and Leon Battista Alberti in the context of architectural drawings and painting. The proscenium stage functions as a one-point perspective box, its frontal view akin to the *tableaux* of a painting. This perspective box offers a different niche of affordances for dance to develop. In the eighteenth century, the influential ballet master and creator of the *ballet d’action*, Jean George Noverre, stressed ballet as painting, emphasizing pictorial composition, *chiaroscuro*, and perspective, even suggesting that dancers be assigned roles according to their stature so as to emphasize the perspectival illusion of depth (Monteiro and Balé, ch. 2). In the nineteenth century, Italian choreographer and dancer, Carlo Blasis, developed the techniques of *pirouette* and *en dehors* (external rotation of the coxofemoral joint) (Mendes 28; Monteiro and Balé), new morphologies of dance movement that emphasized the verticality and frontality of choreography as framed by the perspective box (see Aguiar).

This evolution of the constraints governing the experience of ballet audiences is an example of a supra-individual IT. Regulatory principles developed in the domain

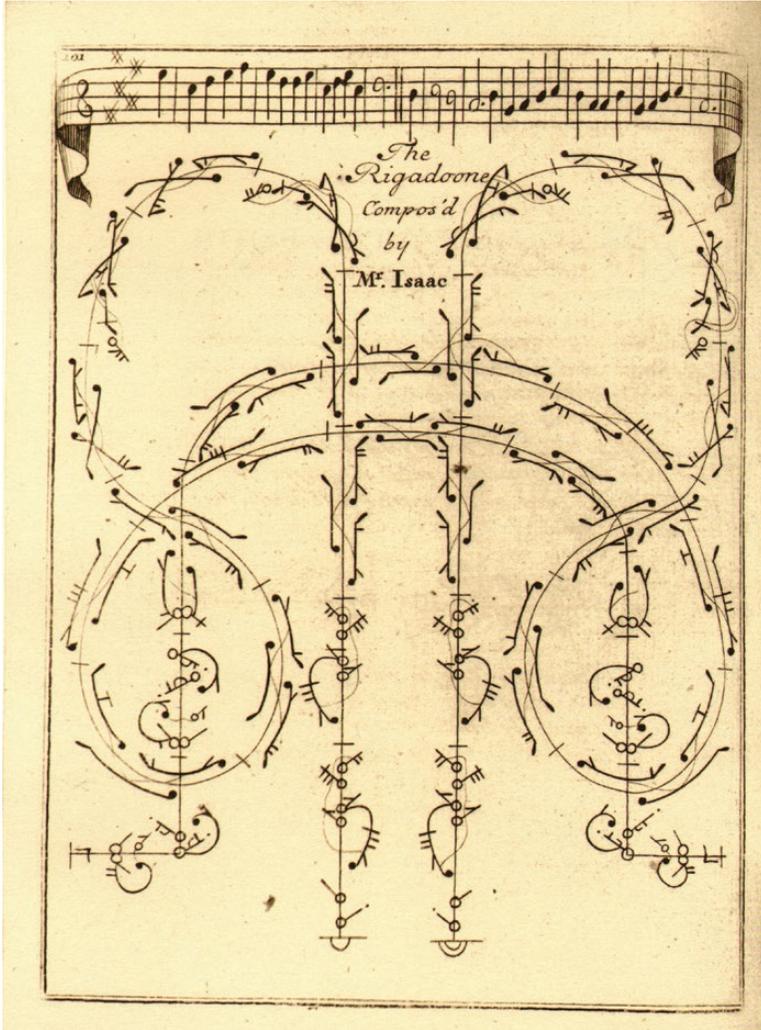


Figure 7. A 1721 dance as represented in the Beauchamp–Feuillet notation. The notation system itself stressed the geometrical character of the dancers’ displacement as viewed from above. https://upload.wikimedia.org/wikipedia/commons/1/1e/Feuillet_notation.jpg.

of painting, especially one-point perspective as a solution for how to represent tridimensional space in bi-dimensional surfaces, ended up helping to determine new semiotic behaviour in a very different semiotic system, dealing with motor coordination and discipline of the body. One-point perspective—a cognitive artefact coming from the domain of painting and bi-dimensional representation in general—used as a design principle in the construction of new theatres led to the development of a new type of performance space (Mendes 28). The verticality of classical ballet developed in this new space of constraints in a very different way than the geometrical horizontality of choreographies designed for great halls and parks (Figure 8).

Merce Cunningham

Merce Cunningham is one of the most important choreographers of the twentieth century, having produced historical innovations in syntax composition, motor vocabulary, and the relation between dance and sound entities, among other things (Copeland). His innovations are related to the introduction of chance procedures and protocols, such as using the I Ching (the chinese *Book of Changes*) to determine different aspects of his choreographic works.⁵ The idea here is that the I Ching works as a protocomputing cognitive artefact to create and explore new problems in dance. Cunningham's innovations can be described as resulting from the introduction and manipulation of new cognitive artefacts (chance-based procedures), producing a new conception of performance space (decentralizing and non-hierarchical space of relations), a new association between music and dance, and a new morphology of body movements. John Cage was systematically exploring the use of several artefacts to produce random effects in music some years before; and Marcel Duchamp had been exploring chance operations in visual arts even before that. In our view, we are describing an IT, to dance, of chance protocols and procedures that were previously used in visual arts and in music. As a result, what we observe is a cascade of events based on the introduction of chance procedures imported from music to dance inaugurating new sets of problems: (1) the sequences of performer's actions are changed, creating an unusual dance syntax and forcing dancers to acquire new skills and reorganize motor coordination; (2) the hierarchical structure of performance space is reframed, as well as the nature of observer positions; and (3) the relations between music and dance are reconceived, and dance as body movement is dissociated from anything else (Figure 9).

Implications of intersemiotic translation as a cognitive artefact

We tentatively built a theoretical frame to the phenomenon of IT in creative arts mainly inspired by (and based on) Distributed Cognitive Science and Peirce's Semiotics.

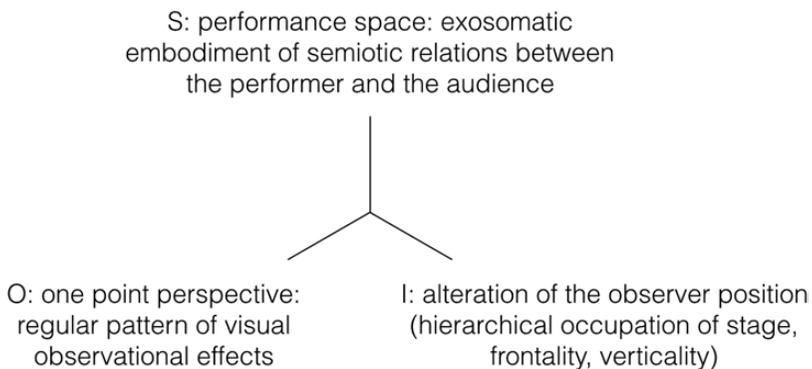


Figure 8. One-point visual perspective is translated to theatre space producing a new set of regular semiotic behaviour on several levels of description, including the occupation of dancers, and the verticality and frontality of body movements. The performance space can be described as the exosomatic embodiment of semiotic relations between the performer and the audience. It is determined by the regular pattern of observational effects produced by a one-point visual perspective creating a new observer position.

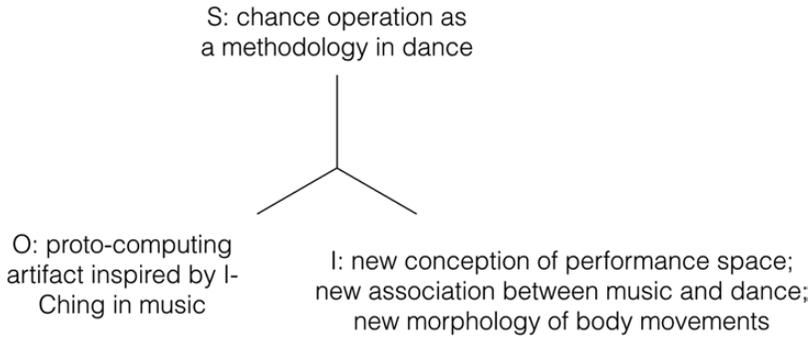


Figure 9. Protocomputing artefacts used in Cage’s music protocols are translated to dance producing innovations such as a new conception of performance space, a new indeterminacy relation between music and dance, and a new morphology of body movements.

IT is a cognitive artefact that scaffolds artistic creativity in several time scales. It works as a projective and generative augmented intelligence technique, providing new and alternative candidates to test surprising patterns of semiotic activity. In contrast to a strong trend in the Philosophy of Arts, Cognitive Aesthetics and Semiotics, artistic creativity is a process centred on the design and exploration of external cognitive artefacts (materials, methods, procedures, protocols, rules, mind structures, physical tools, etc). What does that mean? In terms of explanatory modelling, artistic creativity is usually associated with psychological traits, cognitive abilities, emotional dispositions, mental illnesses, and neural correlates. In all these cases, the main research problems are framed in an internalist framework, according to which cognition is described as the processing of mental and internal representations and in which the role of context and external tools is secondary. The narrative we have developed here suggest something different—artistic creativity is described as a non-psychological process, materially and socially distributed in space-time, and strongly based on the design and use of external cognitive artefacts. This situated view of cognition does not see the individual agent as the centre of creative processes, but as participant in wider cognitive systems dependent on cognitive cultural ecologies (Hutchins 2011). According to our approach, IT is an artefact to scaffold creativity, modifying the conceptual space of the target semiotic system for anticipation of new and surprising events and the generation of competing ideas. Additionally, it works as a tool for meta-semiosis, allowing systematic inspection and criticism of interpretative effects within and across semiotic systems.

NOTES

¹ For a Foucaultian approach to the notion of artefact as an *apparatus*, see Cary.

² We shall follow the practice of citing from the Collected Papers of Charles Sanders Peirce (Peirce, 1931–35, 1958) by volume number and paragraph number, preceded by ‘CP’; the Essential Peirce (Peirce 1998) by volume number and page number, preceded by ‘EP’.

³ In Peirce’s philosophy, creativity is connected to ‘abductive inference’, the type of reasoning responsible for generating hypothesis out of a mass of facts (see Paavola).

⁴ This view is in conflict with the position defended by Eco (2003). Eco stresses cases of ‘adaptations’ which are not ‘translations’, typically because they do not allow an observer to reconstruct the source from the target. We do not consider this criterion (ability to reconstruct the source-sign from the target-sign) to be

necessary for considering some communication a translation. This leaves open the question of how to avoid viewing every communicative activity as a form translation, a question which is similar to the problem of cognitive bloat in Distributed Cognition and of pan-semiosis in Peircean Semiotics. The pursuit of this question is out of the scope of this contribution, and will be the target of future investigations.

⁵ It was in 1953 that Cunningham premiered 'Suite by Chance', the first dance in which space and time were determined by chance protocols (Hering).

REFERENCES

- Aguiar, Daniella. *Sobre Treinamentos Técnicos de dança como Coleções de Artefatos Cognitivos*. Dissertação (thesis), Curso de Dança, Universidade Federal da Bahia (UFBA), Salvador, Brazil, 2008.
- Aguiar, Daniella, and João Queiroz. "Semiosis and Intersemiotic Translation." *Semiotica* 196 (2013): 283–92.
- Atã, Pedro, and João Queiroz. "Multilevel Poetry Translation as a Problem-Solving Task." *Cognitive Semiotics* 9 (2016a): 139–47.
- . "Habit in Semiosis: Two Different Perspectives Based on Hierarchical Multi-level System Modeling and Niche Construction Theory." *Consensus on Peirce's Concept of Habit: Before and Beyond Consciousness (Studies in Applied Philosophy, Epistemology and Rational Ethics)*. Eds. Donna E. West and Myrdene Anderson. Berlin and New York: Springer, 2016b; 109–19.
- Bender, Andrea, and Sieghard Beller. "The Power of 2: How an Apparently Irregular Numeration System Facilitates Mental Arithmetic." *Cognitive Science* 41 (2017): 158–87.
- Bjorndahl, Johanne Stege, et al. "Thinking Together With Material Representations: Joint Epistemic Actions in Creative Problem Solving." *Cognitive Semiotics* 7 (2014): 103–23.
- Boden, Margaret. "Computer Models of Creativity." *Handbook of Creativity*. Ed. Robert Sternberg. Cambridge, MA: Cambridge UP, 1999: 351–72.
- . *Creativity and Art: Three Roads to Surprise*. Oxford UP, 2010.
- Breton, Gaëlle. *Theater*. Stuttgart, Germany and Zürich, Switzerland: Karl Krämer, 1990.
- Brunning, Jacqueline. "Genuine Triads and Teridentity." *Studies in the Logic of Charles Sanders Peirce*. Eds. Nathan Houser, Don Roberts, and James Evra. Bloomington, IN: Indiana UP, 1997: 252–70.
- Burch, Robert. *A Peircean Reduction Thesis*. Texas Tech UP, 1991.
- Campos, Haroldo de. "Translation as Creation and Criticism." *Novas-Selected Writings Haroldo de Campos*. Eds. Antonio Sergio Bessa and Odile Cisneros. Chicago: Northwestern UP, 2007: 312–26.
- Clark, Andy. *Being There: Putting Brain, Body, and World Together Again*. Cambridge, MA: MIT Press, 1998.
- . *Natural-Born Cyborgs: Minds, Technologies, and the Future of Human Intelligence*. New York: Oxford UP, 2003.
- . "Language, Embodiment, and the Cognitive Niche." *Trends in Cognitive Sciences* 10 (2006): 370–72.
- . *Supersizing the Mind—Embodiment, Action, and Cognitive Extension*. New York: Oxford UP, 2010.
- Clark, Andy, and David Chalmers. "The Extended Mind." *Analysis* 58 (1998): 7–19.
- Cluver, Claus. "Klangfarbenmelodie in Polychromatic Poems: Anton von Webern and Augusto de Campos." *Comparative Literature Studies* 18 (1981): 386–98.
- . "Inter Textus/Inter Artes/Inter Media." *Aletria: revista de estudos de literatura* 14 (2006): 11–41.
- Copeland, Roger. *Merce Cunningham: The Modernizing of Modern Dance*. London: Routledge, 2004.
- Crabtree, Susan, and Peter Beudert. *Scenic Art for the Theatre: History, Tools and Techniques*. London: Elsevier Focal Press, 2005.
- Crary, Jonathan. *Techniques of the Observer: On Vision and Modernity in the 19th Century*. Cambridge, MA: The MIT Press, 1990.
- Davies, Jim, and Kourken Michaelian. "Identifying and Individuating Cognitive Systems: A Task-Based Distributed Cognition Alternative to Agent-Based Extended Cognition." *Cognitive Processing* 17 (2016): 307–19.
- Eco, Umberto. *Mouse or Rat? Translation as Negotiation*. London: Phoenix Books, 2003.
- Gorlée, Dinda. *Semiotics and the Problem of Translation, With Special Reference to the Semiotics of Charles S. Peirce*. New York: Rodopi, 1994.
- Gronau, Barbara, Matthias von Hartz, and Carolin Hochleichter. *How to Frame—On the Threshold of Performing and Visual Arts*. Berlin, Germany: Sternberg Press, 2016.

- Hering, Doris. "Suite By Chance." *Dance Magazine XXVIII*, no. 2, Feb. 1954, p. 70.
- Hoffmeyer, Jesper. "Semiotic Scaffolding in Living Systems." *Introduction to Biosemiotics: The New Biological Synthesis*. Ed. Marcello Barbieri. Dordrecht, the Netherlands: Springer, 2007: 149–66.
- Homans, Jennifer. *Apollo's Angels: A History of Ballet* (e-book edition). London: Granta Books, 2010.
- Hutchins, Edwin. *Cognition in the Wild*. Cambridge, MA: MIT Press, 1995a.
- . "How a Cockpit Remembers Its Speeds." *Cognitive Science* 19 (1995b): 265–88.
- . "Cognitive Artifacts." *The MIT Encyclopedia of the Cognitive Sciences*. Eds. Robert A. Wilson and Frank C. Keil. Cambridge, MA: The MIT Press, 1999: 126–8.
- . "Enculturating the Supersized Mind." *Philosophical Studies* 152 (2011): 437–46.
- Kirsh, David. "Problem Solving and Situated Cognition." *The Cambridge Handbook of Situated Cognition*. Eds. Philip Robbins and Murat Aydede. London: Cambridge UP, 2009: 264–306.
- Kissane, Seán (ed.). *Vertical Thoughts: Morton Feldman and the Visual Arts*. Dublin, Ireland: Irish Museum of Modern Art, 2010.
- Jakobson, Roman. "On Linguistic Aspects of Translation." *The Translation Studies Reader*. Ed. Lawrence Venuti. London and New York: Routledge, 2000: 113–18.
- Laland, Kevin, John Odling-Smee, and Marcus Feldman. "Niche Construction, Biological Evolution, and Cultural Change." *Behavioral and Brain Sciences* 23 (2000): 131–75.
- Magnani, Lorenzo. "Creating Chances Through Cognitive Niche Construction." *Knowledge-Based Intelligent Information and Engineering Systems*. Eds. Bruno Apolloni, Robert J. Howlett, and Lakhmi Jain. Berlin, Germany: Springer-Verlag, 2007: 917–25.
- Menary, Richard (ed.). *The Extended Mind*. Cambridge, MA: MIT Press, 2010.
- Mendes, Miriam Garcia. *A Dança*. São Paulo, Brazil: Editora Ática, 1987.
- Monteiro, Mariana, and Tradição e Ruptura Balé. *Lições de dança*. Eds. Roberto Pereira and Silvia Soter. Rio de Janeiro, Brazil: UniverCidade Editora, 1999: 169–89.
- Noë, Alva. *Out of Our Heads: Why You Are Not Your Brain, and Other Lessons from the Biology of Consciousness*. New York: Hill & Wang, 2010.
- Paavola, Sami. *On the Origin of Ideas: An Abductivist Approach to Discovery*. London: Lap Lambert Academic Publishing, 2012.
- Peirce, Charles S. *The Collected Papers of Charles Sanders Peirce* [Eds. C. Hartshorne and C. P. Weiss. Cambridge, MA: Harvard UP, 1931–35, vols. VII–VIII; Ed. A. W. Burks. Cambridge, MA: Harvard UP, 1958, vols. I–VI]. Charlottesville, VA: Intelix Corporation, 1931–35.
- . *The Essential Peirce: Selected Philosophical Writings*. Vol. II. Ed. Peirce Edition Project. Bloomington and Indianapolis, IN: Indiana UP, 1998 [1893–1913].
- Perloff, Marjorie. "Poetry as Word-System: The Art of Gertrude Stein." *The American Poetry Review* 8 (1979): 33–43.
- Petrilli, Susan. *Signifying and Understanding: Reading the Works of Victoria Welby and the Signific Movement*. Berlin, Germany: De Gruyter Mouton, 2009.
- Queiroz, João, and Daniella Aguiar. "C.S. Peirce and Intersemiotic Translation." *International Handbook of Semiotics*. Ed. Peter Trifonas. Berlin, Germany: Springer, 2015: 201–15.
- Queiroz, João, et al. "The Biosemiotic Approach in Biology: Theoretical Bases and Applied Models." *Information and Living Systems: Philosophical and Scientific Perspectives*. Eds. George Terzis and Rob Arp. Cambridge, MA: MIT Press, 2011: 91–130.
- Ransdell, Joseph. "Some Leadings Ideas of Peirce's Semiotic." *Semiotica* 19 (1977): 157–78.
- Savan, David. *An Introduction to C.S. Peirce's Full System of Semiotic. Monograph Series of the Toronto Semiotic Circle*. Toronto, Canada: Victoria College, 1987–88.
- Sinha, Chris. "Ontogenesis, Semiosis and the Epigenetic Dynamics of Biocultural Niche Construction." *Cognitive Development* 36 (2015): 202–09.
- Steiner, Wendy. *Exact Resemblance to Exact Resemblance: The Literary Portraiture of Gertrude Stein*. New Haven and London: Yale UP, 1978.
- Verdi, Richard. "Musical Influences on the Art of Paul Klee." *Art Institute of Chicago Museum Studies* 3 (1968): 81–107.
- Vergo, Peter. *The Music of Painting: Music, Modernism and the Visual Arts from the Romantics to John Cage*. London: Phaidon Press Limited, 2010.
- Wheeler, Michael. *Reconstructing the Cognitive World—The Next Step*. Cambridge, MA: MIT Press, 2005.

- Weiss, Peg. "Evolving Perceptions of Kandinsky and Schoenberg: Toward the Ethnic Roots of the 'Outsider'." *Constructive Dissonance: Arnold Schoenberg and the Transformations of the Twentieth-Century Culture*. Eds. Juliane Brand and Christopher Hailey. Berkeley and Los Angeles: U of California P, 1997: 35–57.
- Zhang, Jiajie. "The Nature of External Representations in Problem Solving." *Cognitive Science* 21 (1997): 179–217.
- Zhang, Jiajie, and Hongbin Wang. "The Effect of External Representations on Numeric Tasks." *The Quarterly Journal of Experimental Psychology Section A* 58 (2005): 817–38.

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