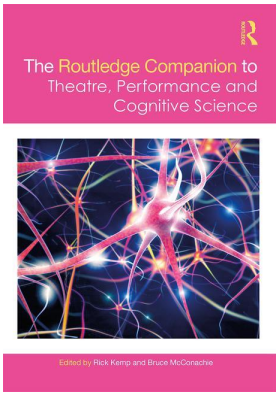

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DISTRIBUTED COGNITION
Studying theatre in the wild

Evelyn Tribble and Robin Dixon

The model of distributed cognition or cognitive ecology that we advance in this chapter takes its inspiration from Edwin Hutchins's ground-breaking book *Cognition in the Wild* (1995). 'In the Wild' refers to the proposition that thought is not best studied in artificial laboratory settings, but rather in real-world environments that have been designed to think with. Experimental settings by definition seek to reduce complexity and eliminate variables; in Hutchins's view, identifying cognitive mechanisms through these means alone provides only a partial picture of human intelligence. Such methods are generally predicated upon individualistic and atomistic models of thought, which cannot account well for the emergent properties of complex group activities. Hutchins argues for the study of 'human cognition in its natural habitat – the material and social surrounds that enable and constrain thought:

> Humans create their cognitive powers by creating the environments in which they exercise those powers. At present, so few of us have taken the time to study these environments seriously as organizers of cognitive activity that we have little sense of their role in the construction of thought.
>
> *(169)*

Hutchins did his fieldwork for the book on board a naval vessel, where he studied the highly complex task of coordinating social, technological and material systems. His central claim was that the thinking needed to manage the taskworld lies not in the individual nor the structure nor the material, but that all these elements are in dynamic interaction with one another. Activity is stretched across and shuttles among cognitive artefacts such as navigation charts and instrumentation, the spatial organisation of the vessel, including the ways that objects are disposed in space, the social structures and hierarchies and the embodied skills and dispositions of the crew. A key result of such a structure is what Hutchins calls the 'social formation of competence,' as the novice learns 'to organize his behaviour so that it produces a competent performance' (280).

Thus, the model of 'distributed cognition' posits that a complex activity such as performance is spread or smeared across resources such as attention, perception and memory; the experience of training as it is sedimented in the body; social structures; and the material environment. As Kourken Michaelien and John Sutton write, the emphasis upon what might

seem like a motley collection of resources is central to the model. The elements 'need not be alike: rather, their distinctive features and capacities complement each other in combination so as to realize the relevant processes collectively' (Michaelian and Sutton 2013: 6). The closely related idea of a 'cognitive ecology' (Hutchins 2010: 705) emphasises the *interplay* of internal cognitive mechanisms and social and physical environments.

It is of course a truism that theatre is a collaborative art coordinating multiple agents in real time to produce its 'magic.' Distributed cognition provides a systems-level account of such coordination, and, importantly, a way of integrating social, material, environmental and technological factors into a robust account of extended and embodied mind that encompasses skilled practice. A key advantage of the model is that it privileges neither agent nor structure *in advance* and thus avoids falling into a binary account of artistic practice of the sort that can plague cultural theory. As Hutchins writes in a later articulation of his theory: 'distributed cognition does not assume a center for any cognitive system' (Hutchins 2014). Indeed, distributed cognition predicts historical change and variation as new configurations of material and social practices emerge. Such models hold promise for analysing collective enterprises that are otherwise difficult to account for. Moreover, the models we sketch here are not just applications; they also offer a way for theatre historians to speculate fruitfully about areas of historical practice that are only partially understood. Historians depend upon documentation, but rehearsal, training and composition practices are very poorly documented in the pre-Modern era. For this reason, we adopt an argument by analogy, using our good understanding of some practices to illuminate our poor understanding of others. By understanding what performers accomplished—for example, the punishing schedule of early modern English playing companies—and by careful attention to the practices that can be documented, distributed cognition allows us to build a model of group intelligence in action, and to explain obscure aspects of theatre history using applications of this model.

In what follows, we present four brief case studies of historical theatrical practice drawn from different eras and cultural contexts. In each case, applying aspects of distributed cognition theory to the historical practice offers fresh insights into that practice, while simultaneously demonstrating the utility of this developing body of ideas.

Early modern English playing companies

Our first case study is the early modern English theatre. As this example has been discussed at length elsewhere (Tribble 2005, 2011), we only trace the outlines here. By the 1590s, several purpose-built theatres dotted the landscape to the south and north of the London city walls, and playing companies competed for customers seeking novelty. Commercial pressures resulted in what seem today like crushing workloads: up to six different plays were performed a week, with relatively little repetition. The cognitive demands of such a schedule seem overwhelming, which prompted some past theatre historians to imagine a rote-like system in which actors simply went through the motions (structure) or were redeemed by a single brilliant playwright (agent).[1] However, the framework of distributed cognition can illuminate how the task-world was managed, without resorting to a deficit model. For example, the practice of learning lines from parts that contained only the actor's lines and his cues worked not just as a means of saving labour and paper, but was an effective way of reducing the 'noise' of extraneous information and allowing the actor to throw focus only upon the most vital task at hand. In turn, playwrights used devices such as iambic pentameter and rhyme, forms that afforded memorisation and also provided a structure for occasional improvisation within the verse form, or 'fluent forgetting.' The plays also used a basic spatial

dynamic that allowed actors to map the fictional world of the play onto the physical world of the stage on the fly, with little need for elaborate group rehearsal. The apprentice system, in which boys were apprenticed to senior players, embedded young players into the company by giving them increasingly complex roles. Like the young midshipmen integrated into the smart environment of the naval vessel, novice actors benefitted from intelligent structures. Distributed cognition posits neither central control nor chaos; it locates thinking not only in the individual head of the actor but also across the entire system, depending upon the particular demands at hand.

Place and space relationships in the comedies of Plautus

The analogy of the insights that textual analysis based on distributed cognition has yielded regarding Elizabethan performance suggests that applying these ideas to the plays of Titus Maccius Plautus (c.254–c.184 BCE) and Roman comic performance generally may prove illuminating. Performed during the regular religious festivals of the Roman Republic, these comedies provide a useful case study into theatrical production under circumstances of particular cognitive pressures on actors. Despite centuries of scholarship on these plays, several aspects of their composition and production remain mysterious. Even the most detailed and persuasive recent treatments of Roman stagecraft – for example, Marshall (2006) and Moore (1998) – do not consider training, rehearsal and specific dramaturgical conventions in depth. There are still many unanswered questions about the plays and their performance, writing and rehearsal practices and the theatrical economy and ecology. In this context, a new methodological approach is justified.

Many of the production conditions of Plautine drama are not atypical of pre-nineteenth-century Western theatre. Trained male slave actors performed, and over four weeks of rehearsal time was probably available to the performers for each festival.[2] While the analogy of contemporary theatre practice has led scholars to assume that the production of Roman comedies would have required a central 'directorial' figure, there is no persuasive evidence for this assumption.[3] Instead, the complex staging demands of Roman comedy may have been met by similar cognitive structures to those described earlier for Early Modern theatre: a 'scaffolded' system of apprentice actor training, actors using only their own part to prepare lines,[4] implicit stage directions encoded in those parts and, in particular, a set of fundamental spatial conventions that reduced the need for rehearsal and distributed the responsibility for performance decisions among all performers, rather than locating it in one agent.

This latter structure is of particular interest for an investigation of Roman comedy using concepts drawn from cognitive ecology. One constraint on theatre production in the Roman Republic is highly anomalous in the broader context of Western theatre history. Roman drama before 55 BCE was performed exclusively in purpose-built temporary structures, erected and dismantled for specific theatrical festivals;[5] there were apparently legal and moral prohibitions on the construction of permanent spectator buildings in force until the first century BCE.[6]

These temporary structures were built in a limited number of public locations, primarily the Forum and near various temples.[7] Since all of these locations had other functions incompatible with the long-term presence of a theatre building, the period of time that such buildings were in place must have coincided closely with the duration of the festival in question. Crucially, this suggests that actors would not have had any prolonged access to the performance venue before the performance event, which would have placed sustained pressure on their cognitive resources. Each performer had to make decisions about entrances,

exits, stage positioning and movement that had not been exhaustively rehearsed under the instruction of a director nor governed by explicit 'stage directions.'

Close examination of the extant plays of the Plautine corpus suggests an effective and pragmatic solution to this contextual constraint: the employment of a series of conventions for stage movement, encoded implicitly in dialogue through verbal formulae and applied in performance as a consequence of the memorisation of lines. These conventions may be grouped into three categories, the first of which will be considered below: those governing the relationship between physical space and fictional place;[8] those governing entrance and reentrance into, or exit from, the stage space; and those governing performer movement across the stage space.

Roman comedy followed a straightforward system for the 'mapping' of fictional dramatic place onto physical stage space. None of the 'scene changes' familiar to contemporary audiences, or the 'wipe and reset' spatial dramaturgy identified by Fitzpatrick in Early Modern plays (2011: 38) would have been observable in performances of Plautine comedies; instead, after the fictional location of each play was established, it was 'fixed.' This method of depicting fictional places has several dramaturgical advantages, but also generates additional cognitive pressures on actors: inconsistencies in use of space by performers are rendered more obvious to the audience, and can lead to serious problems for comprehension of plots.

In the Plautine corpus, the presented fictional location is remarkably consistent: in all extant plays, the scene is a street in a Greek city, in front of one, three or (most commonly, in around two-thirds of extant comedies) two buildings.[9] This street leads to the unrepresented forum or town centre in one direction, and to the unrepresented harbour or countryside in another. A rectilinear stage featuring three doors, two wing-entrances and a long open space would fulfil the representational requirements of every Plautine drama, and it is no coincidence that the later permanent theatres built across the Roman Empire had these fundamental characteristics, nor that nearly every scholarly reconstruction of the temporary stages follows this basic model.[10]

An efficient spatial dramaturgy influenced the allocation of unrepresented 'offstage' places to the elements of this stage space. The fictional buildings would each be represented by one stage door of the three doors on the typical temporary stage. The relative position of these buildings is often uncertain: only six plays in the corpus contain explicit references to the locations of buildings in the onstage/presentational space, and a simple convention for the arrangement of houses may account for this general absence of explicit allocations. For example, the door on stage right may typically have been used to represent the house of the relatively lower-status or less wealthy character in a given play, as Wiles proposes for Hellenistic New Comedy (1991: 44–5). Following a similarly binary logic, the wing-entrance on stage left was always understood to lead to the forum/city centre and associated places, and that on stage right to the harbour or countryside and other distant places.[11]

These binary arrangements of offstage/unrepresented places opposed the local and foreign, closer and further locations, public and private spaces and the private places of some characters with those of others. Most importantly for practical dramaturgy, this system allowed for clear association of character and place, which in turn would have created conditions of 'cognitive thrift' for the performers. Actors who had learnt only their individual 'parts' and had minimal opportunities for rehearsal in the performance venue could nonetheless adopt a relationship to a particular entrance/exit point that would underpin the majority of their stage movement. Across the corpus of Plautine drama, there is a clear default pattern identifiable: characters tend to enter from and exit to the unpresented fictional place with which they are most closely associated, or that has the most obvious dramaturgical relevance

even if not explicitly nominated. Thus, characters foreign to the presented location, or returning to the presented location from foreign places, typically enter from the gate/harbour; actors therefore used the stage-right wing.[12] Local characters, including bankers, moneylenders and parasites, will tend to come from and go to the forum; actors therefore used the stage-left wing.[13] Characters associated with a house onstage enter and exit from that house, and so actors will use the relevant stage door.

Several other implicit conventions are identifiable throughout the Plautine corpus through analysis of repeated verbal formulae and patterns of movement. However, this association of character and place/space is a useful foundation for reconstructions of Roman stagecraft. For the actor unfamiliar with the specific temporary space of performance, adopting a general practice of connecting unrepresented fictional place, access points to the physical stage and the character currently being portrayed would have offered a basic and highly practical default position for exits and entrances even when none of the other conventional verbal formulae were present as cues, and so significantly reduced the cognitive burden of making decisions about movement in performance. The likelihood of problematic inconsistencies in place/space allocations would have been significantly reduced, and the thematic qualities of place, particularly the binary oppositions crucial to many of the plays, emphasised.

Cognitive artefacts in the commedia dell'arte

Distributed cognition does not account only for script-driven models of theatre. In the mode of theatrical performance that has dominated since Aeschylus, recall of previously memorised scripted material and delivery of that material in the presence of an audience has been the fundamental cognitive demand placed on actors; other cognitive pressures (choreography, blocking, gesture, entrances and exits) are closely linked to this dramatic text and the largely pre-rehearsed decisions it motivates or controls in performance.

However, a few theatrical performance genres across Western history have not centred around a dramatic text, instead offering greater or lesser scope for flexible, improvisatory composition-in-performance by the actors. The Atellan farce of second-century B.C.E. central Italy, the *mimus* of first-century C.E. Rome, pre-nineteenth-century *ortaoyunu* in Turkey, contemporary Theatresports™ and some forms of stand-up comedy all exhibit flexible features and encourage composition-in-performance.[14] In several cases, performance works in these forms lack a memorisable dramatic text altogether. The cognitive demands inherent in these performance genres therefore seem to involve less of the recall of specific fixed textual elements and movements fundamental to dramatic theatre, and more the delivery of memorised or partially memorised verbal material, rehearsed physical action and apparently spontaneously generated verbal or physical elements, all arranged into new configurations in every performance. Flexible performance forms therefore provide a fertile field for applications of distributed cognition theory that move beyond memory and consider other aspects of cognition in performance. The following case study draws heavily from Fitzpatrick's landmark 1995 monograph on flexibility, literacy and orality in the *commedia dell'arte*.

The *commedia dell'arte* of Renaissance Italy is perhaps the most distinctive, successful and well-attested historical improvisatory theatre form. *Commedia dell'arte* was essentially a flexible performance form produced by professional companies of actors in Italy between the early sixteenth century and the early eighteenth century. *Commedia* troupes also toured throughout Europe, and the characters and scenarios of *commedia* exercised a defining influence on subsequent generations of actors and playwrights in the literary theatre, including Moliere, Goldoni, Gozzi and Anton Chekhov.

Even during the earliest period of the form's development, *commedia dell'arte* occupied an unusual space between primarily literary and primarily oral cultural practices. The traces of scripted drama, in particular the classical comedies of Plautus and Terence and their revival by the playwrights and actors of the *commedia erudita* in the early Renaissance, were typically present in *commedia dell'arte* performance, particularly in the later period of the form's popularity;[15] the lineage of improvisatory, highly audience-responsive entertainments by *buffoni* and mountebanks in public squares was also crucial (Henke 2002: 50–68). This fertile combination of oral and literate practices and strategies for generating performance material was key to the development of the form, and also led to the use of complementary cognitive artefacts by actors in order to reduce the pressures of moment-to-moment performance decisions. The most important of these artefacts were the *scenario*, a written document that has typically been viewed as equivalent to the dramatic script (Fitzpatrick 1995: 74–8; Henke 2002: 13–15) and the masks, the defining feature of *commedia* and an essential aspect of characterisation and improvisation in the form.

While *commedia dell'arte* is even more ephemeral than many other historical theatrical genres, due to the absence of fully scripted dramatic texts, the extant scenarios constitute the largest and most potentially useful corpus of documents associated with the form (Fitzpatrick 1995: 81). These documents are clearly analogous to the plots utilised in Elizabethan theatrical performance, and like those manuscripts are usefully viewed as essential cognitive artefacts which summarised the fundamental structural aspects of the performance (Bradley 1992; Tribble 2011: 44–54). Much like an Elizabethan plot, a *scenario* was a single document containing an outline of the performance: a summary of the narrative, characters and setting (the *argomento),* various scenes in order of presentation, the characters present in each scene, the defining event/s of each scene, entrances and exits and, occasionally, other information (Henke 2002: 13) The document was displayed backstage, acting as a prompt and guideline for the actors during the performance.

In *commedia*, this outline would be 'fleshed out' by the abovementioned arrangement and rearrangement of rehearsed and unrehearsed material. The actor was therefore spared the cognitive burden of remembering either a script or a complex plot (Henke 2002: 14), allowing them to concentrate on the more important business of flexible composition-in-performance. The physical presence of a document backstage for reference before an entrance could help to maintain a baseline level of coherence in the performance as a whole, balancing what Fitzpatrick describes as the 'elastic' tendency of improvised routines to expand and contract (Fitzpatrick 1995: 225, 263–93). Actors appearing in one scene and then exiting before their next appearance only had to keep the event or events of that single unit of action in mind at a time, and an actor with more continuous stage action could distribute at least some of the cognitive burden involved to their fellow actors.

Crucially, the scenario provided the necessary parameters for improvisation. While a superficial understanding of improvisatory performance processes might suggest that fewer restrictions on decisions made in the moment of performance lead to more successful improvisations, research at both the theoretical and practical ends of the spectrum has clearly indicated a counter-position: improvisation, particularly group improvisation, works best when at least one aspect of the performance genre is relatively fixed, and not open to alteration even if other aspects are constantly being adjusted in performance (Fitzpatrick 1995: 56–60 and 73–8; Henke 2002: 49). *Commedia dell'arte* was no exception; the *scenario* offered actors the necessary outline of essential action and was presumably relatively inviolable, while simultaneously providing a context in which the performer could make a range of impromptu decisions.

However, the relatively fixed structural outline inherent in the scenario was not the only such comparatively inflexible aspect of *commedia dell'arte* performance. The masks synonymous with the form were another crucial cognitive artefact that provided the trained actor with a clear baseline of physical and verbal features from which to improvise. With the exception of the *innamorati* characters that were ostensibly the focus of the plots, and some minor servant roles, each stereotyped character of the *commedia* was associated with a full- or half-faced leather mask of conventional design. These are immediately recognisable to even the casual practitioner of *commedia*: Pantalone's vulture-like beak of a nose and bushy eyebrows, the canine or crocodilian snout of Il Capitano, the drooping eyes and pug nose of Tartaglia, Arlecchino's impish round face and forehead wart and Pulcinella's crooked nose and heavy cheeks.

Mask work, whether in the context of *commedia* or of the modern methods begun by Copeau and continued by Lecoq and others, is still a fundamental element of much actor training, and a key aspect of this training is the idea that the mask shapes character. Instead of the interior, psychologically framed models of characterisation following Stanislavsky, the typical understanding of a theatre mask and the associated stock role is as an exaggerated, external and comparatively simple *persona* that an actor can employ without the need for realism.[16] The situation was similar for the historical *commedia dell'arte*: the masks were a valuable tool that again 'fixed' certain elements of the performance, placing limits on the range and type of physical, verbal and emotional expression available to the actor in a particular role.

These roles were not psychologically complex, instead being based on a defining characteristic (Pantalone's avarice, Arlecchino's hunger, Il Dottore's intellectual pretension) or at most a binary opposition of emotional states (Il Capitano's bluster and cowardice). The visual design of the mask conjured associations with physiognomy, the pseudoscience of connecting moral and emotional traits with facial features,[17] and contemporary experimentation with the stock roles of *commmedia* suggests that each mask encouraged a particular external physicalisation by the actor. The prominent beak of the Pantalone mask promotes a hunched, forward-leaning posture perfect for the portrayal of avarice; the heavy eyelids of Tartaglia motivate a sagging stance ideal for that sleepy, stammering role; the small eyes and proud proboscis of Il Capitano encourage either an aggressive, snarling or a cringing, servile position of head and shoulders.[18]

These are not codified rules of physical presentation for these characters, instead constituting possible starting points for the individual actor to establish a working relationship with a particular mask during training. After training, an actor wearing a mask and assuming the associated role would have performed within conventional parameters for the gestural and movement-related aspects of the performance. Similarly, each mask/persona was correlated with particular verbal patterns, from accent (Pantalone's Venetian or Arlecchino's Bergamask dialect) through to more complex speeches comprising pre-learnt material arranged flexibly (Il Dottore's long-winded lectures, Il Capitano's bravura boasts).[19] A memorised and embodied repertoire of movements, from simple gestures to repeatable decontextualised gag routines (*lazzi*), as well as verbal formulae, was thus associated with each mask type. In performance, this repertoire of actions would provide a baseline of options for the actor regardless of the situations mandated by the scenario, further reducing the cognitive burden of composition-in-performance by reducing the number of variables in play. Understanding the scenario and masks as cognitive artefacts thus offers a clear rationale for their utility in *commedia dell'arte* performance.

Puppet theatre: handspring

Distributed cognition predicts different ways of stretching across environments, social structures, skilled agents and training, rather than treating such non-traditional modes of theatre as aberrations from the norm. Because distributed cognition models do not specify a locus of central control in advance – in other words, because they do not rely upon a pre-determined model of agency, structure or organisation – they may be particularly valuable when thinking through experimental or non-traditional modes of theatre. As shown earlier, *commedia dell'arte* employs the invariable elements of the mask and the scenario as key constraints that in turn guide and enable the more fluid and variable elements of performance. This example also demonstrates the importance of assemblages – the ways that performers integrate material, social and somatic elements into their systems.

We conclude with a contemporary example of such an assemblage: puppet theatre. Puppet theatre has a long history, a vast literature and takes many different forms, and we focus here on just one: the contact puppetry characteristic of the Handspring Puppet Company, which is known for its integration of puppet and human characters within fictions that combine traditional narrative theatre, dance and music.

The integration between humans and puppets includes the way the puppets are designed, their expressive capabilities in relation to the skilled human body, the coordination both among puppeteers and among and between the rest of the cast and the way puppets both mimic and diverge from human movement. Like the masks in *commedia dell'arte*, puppets afford certain kinds of physicalisation. As Basil Jones notes,

> The designer/maker of the puppet is partially responsible for this life the puppet possesses in performance. The jointing (or lack of it) and the structure of the puppet allow for certain forms of expressiveness and not others. The expert designer is acutely sensitive to the movement required by the puppet. So a large part of the liveliness of the puppet is the responsibility not only of the puppeteer but of the puppet's designer/maker as well.
> *(2014: 61)*

In the TED talk 'The Genius Puppetry Behind *War Horse*,' (2011), Handspring's Adrian Kohler and Basil Jones describe the 'evolution of a puppet horse' (2011: 0:21).[20] Puppets, they argue, always 'struggle for life' on stage, and the art of constructing a puppet is a 'piece of emotional engineering' (2011: 2:50). Audiences must become convinced of the puppet's life to engage in the fiction. This project is inherently multi-modal and distributed across a network of agents. The puppeteer designs the puppet in such a way that makes certain movements relatively comfortable and others more difficult. He or she works with materials such as wood, plaster, cord and cloth, all of which have their own 'grains' and affordances. As Kohler notes, the 'single biggest practical consideration with wood is weight. The scale would be determined by the amount of weight a puppeteer could hold above his head for any length of time' (Taylor 2009: 71). So the puppet-maker builds into the puppet certain ways of moving designed to work with the ergonomics of the human body. In turn, the puppeteer(s) or manipulators must flesh these out, literally. Nothing animate is ever completely still; animals, including human animals, constantly engage in micro-movements; even when seemingly frozen, they subtly shift balance, quiver and, above all, breathe. And it is the assent of the audience in that act of breath that above all animates the puppets. As Toby Malone and Christopher Jackman write: 'belief in the horse must be performed and enlivened as much by the spectator as by the actors and puppeteers' (2016: 3).

'The authority of breath,' as Kohler terms it (2009: 66), yokes designer, manipulator and audience. The 'breathed stillness' of the puppet creates a join between puppet and audience: 'The audience, in noticing the tiny in breath and out breath of the puppet, enters into an empathetic relationship with the object that is being brought to life' (Kohler 2009: 66). Because the breath is the sign of animate life, without it the stillness becomes uncanny, and the puppet dies. If a puppet does not breathe, 'the tension created becomes uncomfortable. Eventually the audience breathes out and the bond of trust between audience and puppet breaks down' (Kohler 2009: 99). Kohler and Jones write that they first articulated the primacy of breath when attempting a particularly complicated assemblage: adapting Monteverdi's opera *Il Ritorno d'Ulisse de patria* to the puppet theatre. This production, performed in 1998 and again in 2008, used a triad of performers: the puppet itself, the puppeteer, who controlled the head and one hand, and the singer, who manipulated the puppet's other hand while singing. Only by coordinating the movement of the puppet with the breath and movement of the singer could the audience engage in the lifeworld of the opera. As William Kentridge suggests, such a process involved multiple levels of engagement and processing:

> the principle [was] that the manipulator focuses on the puppet and the puppet looks at the audience and the audience has to look at the manipulator, but then follows the manipulator's gaze (as you do when somebody is focusing on something) to the puppet and then back as they become aware of themselves watching the puppet.
>
> *(Jones 2014: 192)*

Kentridge's discussion underlines the importance of tying together puppet, puppeteer and audience through the manipulation of eye direction and gaze. Humans are highly attuned to gaze direction. As Jones notes, audiences watching *War Horse* become fixated on the horse-puppets almost to the exclusion of everything else, displaying 'an affinity and fascination with the horses' (2014: 65). The power of the puppet is such that it can create complications in integrating language, including traditional scriptwriting, and human actors into the larger fiction:

> The scriptwriter was almost powerless to author scenes where the horse was central. Without an intimate knowledge of the capabilities of the puppet and without weeks of watching the puppet in action, it was impossible to write these scenes in any but the sketchiest ways.
>
> *(Jones 2014: 63)*

So the introduction of puppetry into the cognitive ecology of the theatre profoundly alters the other elements in the production. The affordances of the puppets become the key constraint around which the work must be organised.

In the case of the large puppets such as those used in *War Horse*, coordination is made even more complex by the need to integrate the movements of multiple puppeteers. As Jones remarks,

> Although Adrian's horses are capable of a wide range of expression, *realising* that expression through movement requires of the puppeteers the development of a complex set of coordinative skills both personally and as a group. The two main horses each require groups of three operators. A convincing individual horse with a character of its own can be created only by a formidable act of 'group mind'—a level of coordination far beyond what a scriptwriter could produce.
>
> *(Jones 2014: 64)*

War Horse found a particularly interesting solution to the challenges of such coordination. Horse handlers and partially visible puppeteers alike were costumed as English soldiers, which had the effect of integrating the multi-modal elements of the production. In the TED video, Jones and Kohler brought one of the puppet-horses on stage, managed by a uniformed handler. Coordinating the horse-puppet demanded an extremely high level of concentration for the puppeteers, including both those embedded within the horse and the handler, whose work bridged the roles of actor and puppeteer. The handler maintained a focused gaze on the 'horse' at all times, moving in sync with it, seemingly reining it in when it became agitated, manipulating its head. The concentration needed to manipulate the puppet – the attentive gaze – performed double duty in keeping the puppet 'alive' and in orchestrating its effects, including coordination with the other puppeteers and its connection with the audience's avid gaze.

The examples we have reviewed are deliberately diverse, encompassing historical performance work as well as contemporary and emerging practices. 'Thinking' is sometimes a dirty word in theatre, associated with excessive rationalism and 'being in the head.' But such a critique misconstrues the act of thinking itself – thought is embodied and socially and materially extended. Human cognition is itself naturally eclectic; 'in the wild' it seeks out constraints, hints, shortcuts, scaffolds. Analysis of the workings of such systems in no way diminishes the intelligence and training of those who perform in milieus which test the boundaries of human skill in time-pressured settings. Rather, these models illuminate the workings and mechanics of such accomplishments.

Notes

1 See, for example, Bradbrook (1932) and Stern (2000).
2 In the absence of direct evidence for rehearsal practice, it may be assumed that the popularly elected magistrates responsible for funding and organising festivals were not able to make arrangements for festival events prior to their election, and that the accounts of one festival needed to be settled before contracts for the next one could be offered. This would provide between five and eight weeks of rehearsal time for the regular theatrical festivals in April, July, September and November.
3 For example, Richlin (2005: 64).
4 One such part survives: P. Oxy. 4546. See Marshall (2004).
5 See, among others: Bieber (1939: 326–7); Saunders (1913: 96); Duckworth (1952: 79); Campbell (2003: 67); Beacham (1991: 55ff); Goldberg (1998: 1–4); and Welch (2003: 54–5). These scholars tend to draw on the same few references in the primary sources, which are usually comments in the annals of historians like Livy about the construction of temporary theatres.
6 Valerius Maximus 2.4.2; Tacitus *Annales* 14.20; Velleius Paterculus 1.15.3; Appian *Bellum Civile* 1.28. See also Gruen (1992: 205–10).
7 Cicero, *de Harusicum Responso* 24; Livy 40.51.3; Plautus, *Curculio* 466–85; Valerius Maximus 2.4.6; Campbell (2003: 72–3); Goldberg (1998); Hanson (1959; 13–22); Marshall (2006: 36–43); Moore (1991: 126–39); Saunders (1913: 91–2); Sear (2006: 54–5); Wiles (2003: 32–5, 100–3).
8 The useful terminological distinction drawn in McAuley (1999).
9 Plautus' *Asinaria, Bacchides, Casina, Menaechmi, Mercator, Miles Gloriosus, Mostellaria, Persa, Poenulus, Truculentus,* and *Rudens*, and probably *Cistellaria, Epidicus, Pseudolus* and *Trinummus*, all feature two buildings in the represented fictional place. His *Amphitruo* and *Captivi* feature one building, and *Aulularia, Curculio* and *Stichus* three. For the sake of comparison, Terence's *Andria, Adelphi* and *Eunuchus* feature two buildings and his *Heautontimorumenos, Hecyra* and *Phormio* three.
10 For example, Beacham (1991: 60–1 and 216–7); Beare (1955: 166–70); Duckworth (1952: 82–3); Johnston (1933, 15); Marshall (2006: 49–56); Richlin (2005: 7–8); and many others.
11 There is considerable consensus in the scholarship regarding this convention, although the precise articulation of the binary differs between critics. See Beare (1955: 238–45); Johnston (1933: 68–106); Rambo (1915: 415–30); Marshall, (2006: 5); and others.

12 This pattern is most evident in *Menaechmi*, where the actor playing the foreign twin always uses the stage-right wing and never the left, while his local counterpart does the opposite, thus reminding the audience at every entry which twin is which. See Rambo (1915: 421), and most subsequent editions of the play. Other examples of foreign characters' entries otherwise unmarked by explicit verbal formulae occur at *Asin*. 380; *Bacch*. 170, 384 and possibly 573, 842; *Epi*. 526; *Poen*. 930; *Truc*. 482.
13 The following are otherwise unmarked entries which follow this pattern: *Capt*. 69, 191, 401, and see in particular 478–89, which make this association explicit; *Curc*. 375, 526; *Epi*. 620, 647; *Most*. 532, 653; *Pers*. 53, 164, 329; *Stich*. 155.
14 The useful term 'composition-in-performance' is borrowed from Parry (1971) and Lord (1987). It avoids the associations of 'improvisation' while retaining the sense of invention simultaneous with delivery.
15 Henke (2002: 12–14). As Fitzpatrick notes (1995: 14–15) the influence of the literary *commedia erudita* on the *commedia dell'arte*, particularly early in the evolution of the form, has been overstated by many scholars.
16 See, for example, Eldredge (1996); Johnstone (1981: 143–205) offers an extreme version of this idea.
17 A definitive work of Renaissance physiognomy, Giambattista della Porta's *de humana physiognomonia*, was published in 1586; della Porta was himself a playwright contemporary with the first great flowering of *commedia dell'arte*.
18 These observations are drawn primarily from my own experience as a student, teacher and practitioner of *commedia dell'arte*. There are many textbooks and handbooks for contemporary performers in the form, of which Rudlin (1994) is possibly the best; these can be overly prescriptive about the types of gesture and movement associated with each mask, but the basic principle remains sound.
19 Fitzpatrick (1995: 18–19); Henke (2002: 14–15, 45–9). The verbal material memorised by the actors was the element of *commedia dell'arte* most likely to be drawn from literary sources.
20 Malone and Jackman (2016: 19–20) discuss the orchestration and presentation of the TED talk in the context of the '*War Horse* franchise.'

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