Creativity as Pastiche:

A Computational Model of Dynamic Blending and Textual Collage,

with Special Reference to the Use of Blending in Cinematic Narratives

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ABSTRACT

The theory of *blended spaces* of Fauconnier and Turner (1994,1998), also known as the *many-space model of conceptual integration,* is a bold new theory in cognitive science that unifies metaphor, analogy, metonymy and conceptual combination within a framework of interconnected mental spaces. Through an analysis of cinematic pastiche, a form of creative reuse and structural blending in the development of textual narrative in film, this paper considers the computational basis for modelling blend theory, and describes some dynamical properties of conceptual blending which the current theory of Fauconnier and Turner has yet to accommodate. A specific implementation of blending theory, named *Pastiche*, is presented, and consideration of this model—which is essentially a two-space model of metaphor analysis that has been extended to encompass the many-space requirements of blending—throws light on the deep structural relationship between blending and metaphor as cognitive processes. The computational overlap between blending and metaphor, as made visible by the *Pastiche* system, suggests that the computationally well-understood process of cross-domain structure mapping is the key process at work within blending.

Keywords: *Conceptual Blending, Computational Models, Metaphor, Film, Narrative Structure*

Introduction

The thing that hath been, it is that which shall be; and that which is done is that which shall be done; and there is no new thing under the sun. [Ecclesiastes 1:9]

In declaring that *there is no new thing under the sun*, the unnamed Biblical authors of the above provide a touchstone for a cognitively attractive view of human creativity: simply, *inspiration* is a matter of knowing what to borrow, and *creativity* is a matter of knowing how to reuse and blend that which is borrowed.

This paper considers the computational requirements of a cognitive theory of blended creativity, as exemplified by its use in cinematic pastiche, a process in which two or more narratives are blended together to generate a novel film experience. As traditionally employed in film, pastiche is a clear example of the creative process Koestler (1964) terms *bisociation*, wherein two (often incongruous) domains are *fused*, or *blended*. Nonetheless, this role of blending in cognition has only recently received the significant theoretical scrutiny that it deserves. Based upon the mental spaces model of Fauconnier (1985), and anticipated by the analysis of poetic metaphor in Lakoff and Turner (1989), a conceptual blend is described by Fauconnier and Turner (1994,1998) and Turner and Fauconnier (1995) as a selective merging of, and projection from, two or more conceptual spaces to form an additional, newly instantiated space, which is partially structured by the input spaces but which additionally exhibits some emergent structure of its own. This blended space often directly supports inferences which are not readily apparent from a disjoint consideration of both inputs.

Within this framework then, a metaphoric blend is a conceptual blend whose structural composition is mediated by a metaphoric mapping between the source and target input spaces. By additionally positing a *blend* space in which the metaphor is concretized, as well as a *generic* space that provides the experiential knowledge structures against which the metaphor is interpreted, this model explains why metaphors often exhibit certain structural pathologies, i.e., associations which do not follow from a wholly systematic treatment of the input spaces (as advocated in the work of Gentner, 1983 and Lakoff and Johnson, 1980). This blend space thus allows a metaphor to assume properties of its own which do not arise from either of its inputs. In this sense then the conceptual blend-space model of Fauconnier and Turner subsumes and extends the traditional source:target space model that has dominated the metaphor / analogy literature since Aristotle's *Poetics* (see Hutton, 1982).

This paper has two goals: firstly, we seek to elucidate the requirements of a computational model of metaphoric blending by considering a domain we perceive to be rich in blending, namely cinematic pastiche; this is a complex domain which serves to both clearly illustrate the elements of Fauconnier and Turner's theory, and to point toward perceived areas of the theory which perhaps need bolstering, or at the very least, further clarification. Secondly, we wish to describe a computational model of metaphoric blending, named *Pastiche*, which is an extension to earlier work described in Veale *et al.* (1993, 1994, 1995, 1996, 1997, 1998).

Structure of this paper

This paper assumes the following structure: first, after outlining the motivations and goals of this research in more explicit terms, we investigate the role of blended spaces in the subjective appreciation of cinematic creativity, with particular reference to the use of pastiche in *Star Wars* (1977) and its grounding in the highly productive Arthurian saga. We use this investigation to illuminate the elements of the Fauconnier-Turner model of blended spaces relative to this milieu, and highlight some areas of the model which need to be augmented. Several computational models of metaphor analysis—and the concepts on which they are based—are then described, with primary emphasis placed on the Sapper model of Veale *et al.* (1993, 1994a,b, 1995). The Sapper model is then extended to deal with issues of narrative blending. Finally, ramifications of the overall approach are then discussed, conclusions are drawn, and some future directions of the research are outlined.

Conceptual Blending Theory

In the terms of Fauconnier and Turner, the interacting domain spaces that go into producing a conceptual blend are organized according to Figure 1.

Figure 1 Around Here: Blended Spaces

Shown in Figure 1 are the traditional spaces normally associated with metaphoric mapping — the “Source” and “Target” domains. (For the purposes of the current exposition regarding cinema, these spaces are also labeled as “Theme” and “Genre” respectively, to accord with our later discussion of genre adaptation blends such as *Star Wars)*. Within the Fauconnier and Turner model, these spaces combine via some structural mapping (often a metaphoric one) to produce another, independent blended space which provides the focal point for the resultant integration. However, perhaps the most significant contribution of the Fauconnier and Turner model, over and above the now standard Lakoff and Johnson (1980) two-space perspective on metaphor, is the use of an additional distinct coordinating space, known as *generic space*. This space contains the high-level schemata which can either ground the elements of the blend in real-world experience, or in many cases actually guide the construction of the source:target mapping. In the case of metaphoric blends, generic space specifies the basic conventions underlying a more complex metaphor. For instance, in the Fauconnier and Turner example of *DEATH AS THE GRIM REAPER*, the generic space provides coordinating structures which are relevant to the process of personification.

Because blend-space provides a convenient means of seperating the product of conceptual integration from the spaces that are actually integrated, blending theory yields a compelling account of why many metaphors/blends often give rise to emergent properties that are, in a sense, pathological from the perspective of the contributing input spaces. For instance, consider the now conventional blend *Black Hole* (a term originally coined by the physicist John Archibald Wheeler), which fuses the abstract notion of a bizarre celestial phenomenon (as predicted by Einstein’s Theory of General Relativity) with the notion of a common-place hole or rip. The mediating image-schema in generic space for this blend is most plausibly the notion of *SPACE-TIME AS A FABRIC*, an oft-used metaphor in modern physics. Incorporated into the blend is an additional source space—that of *Blackness*—which contributes an aura of mystery, invisibility and the unknown to the finished concept. But from its inception, this blend ingredient has idiosyncratically conflicted with the ‘hole’ source space inasmuch as it is believed that anything that enters a black hole cannot exit; this conflicts with our folk understanding of the common-place variety, such as potholes, manholes, and so on.

Indeed, advances in modern physics have seen scientists further distance their models of ‘black holes’ from the idealized cognitive models that underlie both ‘blackness’ and ‘holes’. For instance, black holes are no longer considered truly black, inasmuch as they possess an entropy that radiates detectable quantities of gamma rays; more counter to standard intuitions is the related idea that black-holes are *self-filling*, since as radiation is emitted, black-holes lose their energy and shrink, eventually disappearing into themselves (see Hawking, 1975). However, because the blended concept exists in a derived yet independent space of its own, accessible via the distinct lexical item 'Blackhole', such alterations do not corrupt our understanding of the original source spaces labeled ‘Black’ and ‘Hole’.

Blended spaces, or networks of integrated concepts, serve as a powerful framework in which one can describe both the *means* and the *ends* of concept combination. A blend of two or more input spaces can allow a cognitive agent to create novel conceptual structures that increase either its understanding of the world, or its ability to describe that world. From a cinematic perspective then, blend theory can yield both a constructive theory of how new films are created from old, and a descriptive theory of how viewers detect resonances between different films. The latter, descriptive use of blend theory is the primary focus of this paper, since it allows us to examine the resource-dependent appreciation of blending as a subjective process. When interpreting a blend, an agent may detect resonances that were not intended by its creator, or conversely, employ different conceptual spaces in its analysis to nevertheless arrive at the same meaning. Fauconnier and Turner (1998) posit that blends are subject to a *web-constraint*, which allows the original spaces that contribute to a blend to be accessible from the blend. However, this web constraint is prone to producing *parallax effects* when creator and comprehender possess different stores of background knowledge, or employ different biases to organize and retrieve the same knowledge. In essence then, the appreciation of a blend is causally decoupled from the creation of that blend.

A good example of this decoupling can be found in the American system of presidential elections. As in all elections, American presidential races are decided according to the quantity of votes cast for each candidate. However, the Amercian system contains an intriguing twist: votes cast in each federal state decide whether a candidate wins or loses that state outright, so that the winning candidate in each state collects all of the electoral college votes for that state. It is the candidate that wins the most electoral colleges, rather than the most votes overall, that eventually wins. It can seem bizarre then that the candidate that wins the most votes may nevertheless lose the election by virtue of failing to secure the most electoral colleges (indeed, this has happened on occasion, and prompted some politicians to discuss electoral reform). However, this two-tier system is actually more democratic that single-tier *first past the post* systems employed in other countries, since the smaller size of states versus countries means that more voting power (i.e., the ability to turn the course of the election) is given to each citizen. Designed explicitly to minimize the *tyrrany of the majority*, the American system means that a candidate must not only do well in areas where he/she has the strongest support, but also perform reasonably well in other areas as well, thus ensuring the candidate most representative of the country as a whole wins.

Though it is clearly anachronistic to do so, the logic of this system is apparent if one views the system as a blend of POLITICS and TENNIS. It seems entirely fair in tennis that the player that wins the most sets, rather than the player that wins either the most individual points or games, is declared the overall winner. In sports—a competitive domain very akin to politics—a player must demonstrate good performance throughout, when the tide of the game is both for and against. Though not mandated by the founding fathers, this blend is nonetheless systematic with their goals. By the same token, if one recognizes blended themes in a work of art, such as film, that were not explicitly placed their by their creator, this is not to deny these blends an important cognitive reality. Blending theory provides the ideal vehicle to explore this reality.

Cinematic Pastiche as Conceptual Blending

The *creativity as inspired borrowing* philosophy outlined in the introduction finds its fullest expression in cinema, an industry which thrives on the reuse of ideas which have previously been proven to work in other media. The Hollywood film industry, for example, has thrived since its inception on an influx of ready-popularized themes from literature, and often, incestuously, from itself. Indeed, the industry is often criticized for its over-reliance on the repackaging of time-proven ideas in new clothing. However, Hollywood's clear love of pastiche sometimes (albeit not very often) leads to the production of a film which is quite clearly an innovative and inspired blend. George Lucas's *Star Wars* (1977) for instance, was initially criticized by many reviewers for being a lumpen patchwork of fairy-tale conventions re-expressed within the science-fiction genre, yet subsequently lauded (after considerable box-office success) as an imaginative blend of archetypal themes which were to breathe new life and innocence into the film medium.

Many writers have profitably approached the formal study of cinema using a linguistic conception of film; such writers speak both of the *language* of cinema and the *grammar* of film (e.g., see Arijon 1976; Whittock 1990). Ultimately, film is a visual manifestation of an underlying *textual* form—the *script*—which controls almost all aspects of a film, from the dialogue of the actors to the structure of each scene to the elements of *mise-en-scène* (shot composition). Following in this linguistic framework, this paper attempts to apply the vocabulary of cognitive science and artificial intelligence to the film form. In particular, the notion of conceptual blending as currently developed in these fields is used to throw light on a mainstay of the modern cinematic experience, *pastiche*.

Pastiche and Intertextual Collage

Cinematic Pastiche occurs whenever multiple narrative elements, drawn from varying sources, are stitched together to form a new narrative whole; sometimes the stitches do not show, but more often than not they are plainly visible (sometimes because of ineptitude, othertimes to form a post-modernistic allusion). Motivations for resorting to pastiche also differ, ranging from the automatic and unconscious to the deliberate and ostentatious. For example, the semiotician Umberto Eco (1995) provides an analysis of *Casablanca* (1941) which argues that this film—frequently cited (and justly so) as one of the great cinematic treats—is in fact an *inter-textual collage* of the many other movies of the time from which the director Michael Curtiz had learned his trade. Eco's critique hinges on the choppy characterization employed in the film, suggesting that the main characters are simple assemblages of traits from other films. In Eco' view, Curtiz resorts to pastiche for the same reasons that class idiots resort to plagiarism.

Not everyone will agree with Eco's critique (which seems quite churlish given the near-universal respect in the which the film is held). However, a less tendentious example of successful pastiche is George Lucas's *Star Wars* (1977), about which the critic Pauline Kael (1980) makes the following, equally critical, remarks:

> [I]t's an assemblage of spare parts ... Star Wars may be the only movie in which the first time around the surprises are reassuring. [...] Maybe the only real inspiration of Star Wars was to set its sci-fi galaxy in the pop-art past, and to turn old-movie ineptness into conscious Pop Art. [...] In a gesture toward the equality of the sexes, the high-school-cheerleader princess-in-distress talks tomboy-tough [...] Is it because the picture is synthesized from the mythology of serials and old comic books that it didn't occur to anybody that she could get The Force? (Kael, 1980)

Star Wars, as we shall argue, is an example of wholesale pastiche, in which blending of old narratives operates on every level. Other films, such as *Raiders of The Lost Ark* (1979), often employ pastiche is a more directed and less global fashion; for instance, as Rosenbaum (1995) notes, the closing scene of *Raiders* is clearly a borrowing from that of *Citizen Kane* (1941). But ultimately, this sense of déjà vú that signals the use of pastiche is a subjective phenomenon. Neither Eco or Kael can truly say what influences have shaped the construction of a narrative — the best a critic can do, as in law, is to build a compelling case for pastiche. In this paper then we do not offer our analyses, and those of our computational model Sapper, as hard fact of an author's recourse to borrowing. Rather, we seek to throw light on this otherwise ineffable creative process by concentrating on how its results are perceived by an observer. This line of attack mirrors that used in research into metaphor comprehension, which has traditionally been used to yield insights into the reciprocal processes of metaphor generation.

Our work gives tacit support then to the old adage that is it easier to be a critic than a creator, and easier to show that a certain narrative is, in Kael's terms, an assemblage of spare parts than to locate and assemble those spare parts oneself. However, we derive our motivation both from a belief in cognitive parsimony and the conventional wisdom that within each critic lies a failed (or perhaps, merely thwarted or suppressed) artist, to argue that many of the computational mechanisms we construct to model this critical faculty will take us a step closer to modeling true conceptual creativity, whether strictly verbal or cinematic.

Must All Narratives Be Seen As Blends?

As complex conceptual objects which are rooted in consensus world knowledge, a cinematic narrative clearly has a potentially unbounded number of facets it may share with other narratives. But many of these points of similarities will be trivial from the perspective of assessing originality: for instance, *Vertigo* (1958) should not be seen as a reworking of *Rear Window* (1954) simply because both share a director (Hitchcock) and male star (James Stewart). Likewise, it would stretch credulity to claim that *Ishtar* (1987) is a blend of *Lawrence of Arabia* (1962) and comedy, merely because both involve recalcitrant camels and a large quantity of sand. Many other false attributions may be due to the observer bringing a particular mind-set to the interpretation of a narrative. For instance, the critic Pauline Kael (1980) has claimed that films of the director Steven Spielberg—such as *Close Encounters of the Third Kind* (1977) and *E.T.* (1982)—exhibit clear borrowings from *Christian* tradition, while the Jewish director politely but understandably demurs to such claims.

In fact, the problem of genre identification and contextual placement is a vexingly subjective one that resides squarely in the ideas of film and narrative themselves, rather than to those efforts to computationally model these concepts. For example, human critics frequently disagree about even the broad genre classifications of a narrative; Billy Wilder's *Sunset Boulevard* (1950) strikes some critics as a satirical comedy, and others as a dark horror. As the critic Ed Sikov notes with regard to this problem of genre identification, *"scripts* [could] *be fed into computers in order to classify them, but this would classify the scripts, not the films"* (Sikov 1994). Yet as undecidable as the task might seem, we take the view that even such a text-fixated computer will shed light on the structure and composition of cinematic narratives.

It follows then that it makes little sense to claim that all narratives are blends of others, and that literally, there is nothing new under the sun—such a claim robs the analysis of pastiche of all practical merit. But how should a model of pastiche discard such wrong-headed cases? (We are careful to note that this concept of "wrong-headed" is entirely subjective; however, this does stop us from constructing a subjective computer model that exhibits a sense of judgment akin to our own). We believe the model of pastiche described in this paper to possess the adequate conceptual apparatus to exercise such judgment, though the problem is too complex to provide a complete solution at present. For example, the lure of trivial similarity is overcome by providing a measure of deep structural match and coverage, which notes not only how many features two narratives have in common, but how rich the overlap is in terms of causal structure. Likewise, the issue of false attributions on the part of an observer is addressable in principle by positing the author to be operating within a different generic space than that of the observer (the generic space of Pauline Kael, for example, seems firmly rooted in religious tradition).

In the final analysis then, an analysis of narrative pastiche resembles a legal (rather than formal) proof, in which a preponderance of structural evidence is marshaled in support of a particular blend hypothesis. In this respect, the computational models presented in this paper provide useful tools for this endeavour.

Computational Models of Metaphor and Analogy

Metaphor, blending and bisociation are all cognitive faculties which are typically defined as mapping processes between knowledge domains (or what Koestler (1964) nebulously terms '*matrices'*), that is, processes that first determine those elements of each domain which contribute to the mapping, and then place these cross-domain counterparts in correspondence. In this section we consider three alternate computational models of the structure-mapping process: The SME model of Falkenhainer *et al.* (1989), the ACME model of Holyoak and Thagard (1989) and the Sapper model of Veale *et al.* (1994, 1995, 1996,1997, 1998).

We look to such theories to provide a coherent means of relating elements in the input spaces according to the structural/semantic roles each plays in their respective space, such that only a systematic overlap of conceptual structure between these spaces is projected into the blend space. For instance, consider the transparent blend basis of the film *'The Natural'*, which is a baseball retelling of the classic Arthur saga. For such a blend, we expect a mapping theory to recognize the set of correspondences outlined in Figure 2.

Figure 2 around Here "The Natural as King-Arthur"

The analogical mapping of Figure 2, in this instance produced by the Sapper model, serves as the tailor's blueprint for the blend as it is ultimately realized on film (i.e., it dictates the lines alone which the narratives are to be *stitched*) . Within this blueprint, other metaphors are *recruited* as needed (to use the terminology of Fauconnier and Turner) to firmly tie corresponding elements together. For instance, *BASEBALL-BAT AS SWORD* and *UNIFORM AS ARMOR* are sub-metaphors which are recruited to unify higher-level concepts such as *PLAYER AS KNIGHT*, and thus unify the whole.

Computational Elements

The process of cross-domain mapping—around which this current work elaborates its theory of narrative blending—has been the subject of intense scrutiny and investigation in the fields of Cognitive Science and Artificial Intelligence (e.g., see Gentner, 1983; Falkenhainer *et al.*, 1989; Veale *et al.* 1994, 1995, 1996b, 1997, 1998). A small set of core computational ideas have provided the foundations of this investigation, with notions such as semantic networks, spreading activation and graph/structure isomorphism providing the most theoretical utility. We now briefly provide an exposition of these ideas, before turning to a discussion of how they have been used to give computational substance to theories of metaphor and analogy.

Semantic networks.

A semantic network, as defined in Quillian (1968), is a graph structure in which nodes (or vertices) represent concepts, while the arcs between these nodes represent relations among concepts. From this perspective, concepts have no meaning in isolation, and only exhibit meaning when viewed relative to the other concepts to which they are connected by relational arcs. In semantic networks then, structure is everything. Taken alone, the node SCIENTIST is merely a syntactic token that happens to possess a convenient English label, yet from a computer's perspective, even this label is an arbitrary alphanumeric symbol. But taken collectively, the nodes SCIENTIST, LABORATORY, EXPERIMENT, METHOD, RESEARCH, FUNDING and so on exhibit a complex inter-relational structure that can be seen as meaningful, inasmuch as it supports inferences that allow us to conclude additional facts about the SCIENTIST domain, as well as supporting semantic regularities that allow us to express these facts in a language such as English (e.g., see Veale and Keane, 1992).

Long-term memory can be seen as a complex graph structure then in which ideas, events and experiences are all represented in this arcs and nodes fashion (we shall refer to the network representation of long-term memory as 'semantic memory'). A defining aspect of semantic networks is that the representation of these ideas will interweave by virtue of sharing common nodes and arcs. For example, the concept node OPPENHEIMER will partake in relations that link it to the domains of SCIENCE, WAR, POLITICS and ETHICS. A conceptual domain in a semantic network is a structured collection of nodes and arcs that can be reached by recursively traversing all arcs that originate at a given conceptual node.

Figure 3 around Here "Microsoft and CocaCola networks"

For instance, Figure 3 illustrates both a sub-section or domain of semantic memory reachable from the concept node MICROSOFT, as well as a structurally similar semantic domain reachable from COCACOLA. Note how the connectivity of the concept MICROSOFT means that concepts relating to NETSCAPEINC are also included in this domain, while the connectivity of the COCACOLA domain causes the concept PEPSICO and its associates to likewise be included there. The domain of MICROSOFT thus comprises all those concept nodes and relations that can be reached by starting at the node MICROSOFT and its immediate neighbours, visiting the neighbours of each new node in turn until no further nodes can be reached.

Spreading activation.

This recursive node-visiting process is traditionally called *spreading activation* in the cognitive/psychological literature (e.g., see Quillian, 1968; Collins and Loftus, 1975), and *marker passing* in the computational literature (see Charniak, 1983; Hendler, 1989). From the former perspective, not only are neighbouring nodes visited in a wave-like progression from the starting node, but an activation signal is propagated as well, from node to node. This activation signal has an initial value (or 'zorch', as it is often called in the computational literature; see Hendler, 1989) which diminishes and attenuates the further the wave is propagated from its starting point. This attenuation might be specific to the arc carrying the activation (e.g., some arcs in the network might be more or less *conductive* than others, reflecting their salience) or constant across the network (e.g., traversing any arc causes 10% attentuation). The amount of activation a node receives is thus an indication of how far it is from a particular starting point. In cognitive terms, the more activation a node receives, the more central it is to a given domain. If one views a conceptual domain as a *radial category* (see Lakoff, 1987), highly representative concepts (nodes) of that domain will receive significant activation, while less representative members will receive less.

Spreading activation can be simultaneously initiated from a number of starting points in a semantic network (these points are typically called *matriarches*; see Quillian, 1968), where the activation level of a given node is the sum of the activation it receives from different waves. For instance, the concept nodes SOFT and MASSMARKET are each reachable from both the nodes MICROSOFT and COCACOLA, as shown in Figure 3. These nodes can thus be isolated as a potential common ground for viewing *MICROSOFT* as *COCACOLA*. The process of marker passing is similar to that of spreading activation, and is used in contexts where distance between nodes is not an issue. Rather than use activation signals, marker passers instead propagate distinct symbols from node to node; these symbols, termed *markers* or *colours*, effectively mark each node as being reachable from a given starting point. For example, Charniak (1983) uses marker passing to explore semantic memory for connecting structure that will place certain key concepts of a narrative into a coherent event framework. For instance, given the utterance *"Bill felt suicidal. He reached for his belt."*, Charniak's marker-passing model would determine a conceptual path between the concepts SUICIDE and BELT, one that passed through the intermediate nodes HANGING and CHAIR. In this way, spreading activation and marker passing can be used to fill in the conceptual blanks and facilitate the drawing of high-level inferences. So looking again to Figure 3, we see that MICROSOFT relates to NETSCAPEINC not merely by a direct rivalry relation (i.e., both negatively affect each other), but by virtue of negatively influencing to each other's market share.

If a network is highly connected, spreading activation may well visit most, if not all, of the nodes in semantic memory. As Charniak notes, unchecked marker passing can lead to intractable processing problems, by giving rise to a potentially unbounded number of inferential pathways. Practical computational limits thus need to be placed on this idea of a conceptual domain. Typically, these limits take the form of an activation *horizon* or threshold beyond which a wave (of markers or activation) is not allowed to proceed. For instance, a threshold of 0.01 might be placed on the allowable attenuation of each activation wave, effectively causing a wave to terminate if its activation strength falls below this limit. Alternately, a fixed horizon of arcs might be placed on each wave. For instance, a horizon of six would mean that only those nodes reachable within six arcs or less from the starting point would ever be visited by the traversal process.

Graph isomorphism.

Given a representation of domain knowledge, we are in a sufficient computational position to describe the process whereby two or more domains are structurally reconciled. This reconciliation may take the form of a structural comparison, an analogical mapping, or a blend. In each case, coherent correspondences must be established between elements of each domain as a guide to the reconciliation process. In the computational literature, this correspondence problem is traditionally seen as one of sub-graph isomorphism, whereby a connected subset of nodes and arcs in one domain structure are placed into a one-to-one alignment with equivalent elements in another domain (e.g., see Falkenhainer *et al.*, 1989; Indurkhya, 1992; Veale and Keane, 1997). The goal of the graph isomorphism algorithm is to determine the largest subset of nodes and arcs in each domain that are alignable in this way. Because the algorithm has to reason about potential groupings of nodes and arcs, of which there are a combinatorial amount in each domain structure, an optimal solution to this problem whereby the largest isomorphism subsets are determined will most likely require an exponential amount of time to attain (in computational terms, we say the problem belongs to the class *NP-Hard*; see Garey and Johnson, 1979).

At the heart of analogy and metaphor then is posited a structure-mapping process that is responsible for creating an isomorphic correspondence between semantic sub-structures of two domains (in metaphoric terms, the tenor and vehicle domains). Isomorphism is a mathematical notion that guarantees the systematicity and coherence of any resulting interpretation, by ensuring that each relation and object of the tenor domain receives at most one correspondence in the vehicle domain. Isomorphism appears central to metaphor and analogy because, in logical/computational terms, all meaning is expressed via structure; if a cognitive process does not respect structure, it cannot respect meaning, and thus, cannot itself be a meaningful process. Indeed. though it is a graph-theoretic mathematical notion, isomorphism is implicit in the writings of many non-mathematical philosophers of metaphor. Black (1962), for example, describes metaphor as a process in which a blackened sheet of glass inscribed with translucent markings (the vehicle) is placed over a visual scene like the night sky (the tenor). Since only those stars which show through the markings are visible to the observer, a sub-graph isomorphism between glass and scene is created (e.g., the stars of the *Pegasus* constellation might be picked out by a glass inscribed with a picture of a winged horse). Structural isomorphism is also important to blending, not merely because the blending framework subsumes that of metaphor, but because Fauconnier and Turner (1998) posit that blends are subject to a *topology constraint* that ensures that the input spaces are combined in a consistent fashion to produce the blend. For the purposes of this work we view graph isomorphism as the most viable computational means of enforcing this constraint.

Path structures.

The importance of structural isomorphism in counterfactual thought and argument by analogy (two phenomena for which blending/conceptual integration theory provides an appealing model), is readily illustrated by the topical example illustrated in Figure 3. Chafing under the U.S. government's decision in a recent anti-trust case against Microsoft (on behalf of the competion rights of a rival company, Netscape inc.), Microsoft's CEO and chairman Bill Gates argued that to expect Microsoft to distribute Netscape Navigator as part of the Windows'98 operating system was as irrational as expecting CocaCola to bundle three cans of Pepsi with every sixpack of Coke. Note how the analogy has the counterfactual feel of a good conceptual blend; in effect, Gates is saying "If I *were to* bundle Netscape with Windows, that would by as crazy as …". And the blend is a good one, for it grounds the corporate rivalry between Microsoft and Netscape in the well-appreciated, indeed almost visceral, fear and loathing that has traditionally existed between CocaCola and PepsiCo. Both of the latter sell near-identical products in an intensely competitive market, where the most apparent sources of marketability are brand recognition and customer loyalty. Like Netscape Navigator and Microsoft's rival browser, Internet Explorer (or *IExplorer*), both products have little to distinguish them at a content-level, so a company using its distribution mechanisms to deliver a rival's product to the market-place can be seen as financial suicide.

Highlighted in Figure 3 are the relational chains that might conveniently be termed the *backbones* of each domain structure. We see that MICROSOFT creates (and controls) WINDOWS'98, which in turn contains the browser IEXPLORER, which creates a market for itself denoted IEXPLORERBASE, which in turn reinforces MICROSOFT as a company. Similarly, we note that COCACOLA creates (and controls the content of) COKESIXPACKS, which contain cans of COKE-branded soda, which generate a market for themselves denoted COKEMARKET, which in turn reinforces COCACOLA's corporate status. In representational terms suited to later algorithmic exploitation, we denote these relational chains using the notation of a semantic pathway, yielding the semantic pathways MICROSOFT—*create*→WINDOWS—*part*→IEXPLORER—*create*→ IEXPLORERUSERBASE—*affect*→MICROSOFT and COCACOLA—*create*→COKESIXPACK —*PART*→COKECAN*#6*— *create*→*COKEMARKET*—*affect*→*COCACOLA* respectively. Both of these pathways are structurally isomorphic, and are ultimately grounded in a sub-metaphor that reconciles MICROSOFTSOFTWARE with COLASOFTDRINK (both are, in a sense, "soft" products that are aimed at the mass market). This isomorphism should allow an algorithm to generate a partial interpretation of the analogy that maps MICROSOFT to COCACOLA, WINDOWS'98 to a COKESIXPACK, IEXPLORER to a COKECAN (labelled COKECAN#6 in the semantic memory of the system) and IEXPLORERUSERBASE to COKEMARKET.

MICROSOFT and COCACOLA are viewed in network terms as the root concepts of each domain (and hence, of the analogy), causing all isomorphic pathways within a certain horizon, or size limit, originating at these nodes to be considered as the basis of a new partial interpretation. Typically, an algorithm should only need to consider pathways that comprise six relations or less, a modest computational bound that should nonetheless allow it to model analogical reasoning that involves six levels of recursion, a significant cognitive feat from a human perspective. So when all partial interpretations within this limit have been constructed, the algorithm will have mapped PEPSICO to NETSCAPEINC, NETSCAPENAVIGATOR to a can of Pepsi (labelled PEPSICAN#6 in semantic memory), and NETSCAPEUSERBASE to

PEPSIMARKET. It simply remains for the algorithm to choose a maximal set of partial interpretations that can be merged together to form an overall interpretation of the analogy that is rich yet internally consistent.

When the number of partial mappings is small, all possible combinations can be examined in an attempt to find a non-conflicting set that produces the richest overall mapping. When the number is too large to permit exhaustive search of this type, a heuristic approach must instead be pursued, whereby the richest partial interpretation is chosen as a the backbone of the analogy, and other interpretations are aggregated around this backbone if it does not violate structural isomorphism to do so (this latter approach is termed a *greedy* algorithm, since it concentrates the bulk of its processing resources into developing a single hypothesis; greedy algorithms are the basis for Falkenhainer, Forbus and Gentner's (1989) SME model, and Veale and Keane's (1994; 1997) Sapper model).

Surface and Deep Similarity

As noted in Gentner (1983) and Falkenhainer *et al.* (1989), two conceptual structures/ domains can be considered similar according to either a surface measure of perceptual similarity amongst corresponding elements, or according to a deeper, structural measure of systematic overlap. In the former case, two domains are considered similar if elements of each share a degree of superficial similarity, while in the latter, the causal/semantic role played by each in their respective domains is the major criteria of similarity. We can expect surface remindings then to be a source of less cognitive resonance than deeper, structure-based remindings that also exhibit the superficial veneer of perceptual similarity. For instance, consider the mapping of Figure 4 (offered by a early reviewer of this paper), which relates *Star-Wars* to the *Wizard of Oz*.

Figure 4 around Here "Star-Wars as the Wizard of Oz"

The individual mappings of Figure 4 are clearly motivated by surface similarities between the entities concerned. For instance, R2D2 maps to TOTO because both are small, non-verbal and loyal companions, while C3PO maps to the TIN-MAN for more perceptual reasons (both are metallic, jerky and in need of oiling). The mappings between STORM-TROOPERS and MONEYS, JAWAS and MUNCHKINS, and DEATH-STAR and WITCH-CASTLE are similarly motivated. However, the mappings between PRINCESS-LEIA and the WIZARD, and between HAN-SOLO and the SCARECROW, feel altogether more forced. Overall, one is left with a feeling that beneath the surface, the mapping does not quite hang together in terms of the causal structure of both domains. A theory of structure-mapping can quantify this feeling of dissatisfaction, in terms of both the level of surface similarity (i.e., shared attributes) and deep structural overlap (i.e., how recursively nested is this overlap). In turn, blends can be quantified in terms of how well their constituent domains mix together via the mapping lattices (such as those of Figure 4) that link these conceptual spaces to each other.

Relevance and the Frame-Problem

Clearly, both the cognitive and computational plausibility of such mapping processes is contingent upon the availability of an adequate theory of relevance to filter out of each, potentially huge, domain the contributory elements of the mapping. This issue of relevance is closely tied to a philosophical problem in Artificial Intelligence known as the *Frame Problem* (see e.g., Crockett 1994), a problem of inferential relevance originally defined in the context of *situation semantics* (in which the world is viewed as a sequence of situations/frames linked by transitions/actions), but one which is now widely believed to apply to all inferential systems which operate within the morass of human world knowledge.

Since any two arbitrary domains of human knowledge may have an unbounded number of points of intersection, one can see that Koestler's claims regarding bisociative mapping carry little computational weight. Ironically in fact, though the Frame Problem is still a source of much heated debate in philosophical AI (see for instance Dennett (1984), for perhaps the most clear-headed exposition of the problem and its potential solutions), practical AI research often makes tacit representational assumptions that are tantamount to denying the existence of the problem. As we shall see, the SME and ACME models of analogical mapping assume (unrealistically, we claim) that the domain descriptions upon which they operate have *already* been extracted from the mass of world knowledge possessed by the system, in effect preempting any issues of relevance deriving from the Frame Problem. In contrast, the Sapper model makes no such assumption, operating as it thus with the entire contents of long-term semantic memory rather than with shrink-wrapped subsets thereof. While not claiming to solve the Frame Problem, Sapper employs notions of structural systematicity (which are also employed by SME and ACME, but *after* both analog domains have been circumscribed) to actually perform the circumscription of the bisociated domains, and extract the elements of those domains which it believes will contribute to its final interpretation in a structurally coherent manner. Thus, Sapper assumes a limited, pragmatist notion of relevance, *"that which is relevant to Sapper's own structural processes"*. While clearly not a solution to the general problem of relevance determination, this position does allow one to tractably consider interesting problems of blending and bisociation within a computational setting.

We now present an overview of the SME, ACME and Sapper algorithms. The interested reader is directed to Veale *et al.* (1995, 1996b, 1998) for further details on Sapper's operation. In particular, Veale *et al.* (1996b) describes a favorable experimental comparison between Sapper and ACME and SME, while Veale *et al.* (1997) presents a complexity analysis of Sapper which demonstrates it to possess polynomial time bounds for the entire interpretation process, even that process of extracting the relevant elements (in a Sapper sense) from long-term memory.

SME: The Structure Mapping Engine

As described in Falkenhainer, Forbus and Gentner (1989), the original SME—the *Structure Mapping Engine*—occupies one extreme of a functional continuum, and may be described as an exhaustively *optimal* and *maximal* approach to structure mapping. SME tirelessly produces all possible interpretations of a given analogical pairing, where each alternate interpretation is deemed maximal in the sense that no additional correspondence can be added to it without destroying its internal 1-to-1 consistency. Additionally, SME is optimal in the sense that it scores each alternate interpretation, and indicates the best mapping according to a predefined systematicity metric.

Actually, SME is a *configurable analogy toolkit*, capable of applying different match criteria to different types of mapping tasks. Furthermore, heuristic modifications to SME are reported in Forbus and Oblinger (1990) which replace the factorial merge stage of the original algorithm with a new *greedy* sub-optimal process that trades competence for polynomial-time performance. However, as argued in Veale *et al.* (1996, 1997), even with such modifications SME is fundamentally unsuited to the mapping of structures in which richly detailed character/object descriptions—as opposed, say, to high level causal actions—play a central role. Since narrative structures can combine action and character in equal measure, this leads us to doubt SME's applicability to the problems of blended narratives.

In SME parlance, a systematic collection of inter-structure correspondences is termed a *gmap* (global mapping). Initially, a set of partial correspondences (called *pmaps*) is constructed by systematically comparing the corresponding arguments of identical predicates in each structure. Whereas in our earlier description of graph-isomorphism we spoke of generating mapping between isomorphic *pathways*, SME is a *tree-based* algorithm, inasmuch as it attempts to determine local isomorphisms between the tree-like hierarchical grouping of predicates in its semantic domains (e.g., *cause(X, convince(Y, do(Y, Z)))* is a tree structure with *cause* as its root level and *do* at its leaf level). Ultimately however, a tree is simply a set of divergent pathways with common starting-points, so both perspectives are computationally interchangeable.

These initial pmaps are then combined to produce successively larger combinations of mappings until a set of maximal global mappings, or gmaps, is generated. Clearly, the size of the initial pmap set is a key factor in the tractability of the SME combination process; SME employs the notion of *structural support* to limit the size of this set, exploiting systematicity across the nested organization of predications in each structure as an evidential basis for generating new pmaps. However, we demonstrate in Veale *et al.* (1996a,1996b) that this support is not at all visible to SME in object/character-based metaphors, which tend to involve many shallow, tree-structured representations linked via common leaves, rather than a few, deeply nested tree representations linked via common superclasses. In tightly plotted narratives, such as the tales of Aesop and the tragedies of Shakespeare, there is sufficient causal structure to create rich hierarchies for SME to operate upon (see Law, Forbus and Gentner, 1994). But in character-driven narratives that emphasize the semantic make-up of individuals, and the pairwise relations that connect them (such as *CONTROL, AFFECT, HINDER*, etc.), SME lacks the hierarchical structure to build rich pmaps, and instead produces many impoverished pmaps. This greatly exacerbates the complexity of the SME combination process.

ACME: The Analogical Constraint Mapping Engine

ACME, the *Analogical Constraint Mapping Engine*, is another tree-based approach that places great emphasis on the property of mapping *systematicity*, or *isomorphism*. Nonetheless, ACME eschews the exhaustively optimal and maximal strategy pursued by SME. Instead, ACME constructs a constraint network for each new problem to model the various pressures of similarity, context and isomorphism which shape the overall interpretation of a metaphor or blend. This network is the subject of a parallelized constraint relaxation process, from which a sole interpretation emerges, one that is neither guaranteed to be optimal, or maximal, or, for that matter, even wholly systematic. Unlike SME then, ACME guarantees *nothing*, embodying a heuristic rather than complete approach to the problem. Indeed, ACME pursues what may be called a *natural* or *evolutionary* model of computation, in which environmental forces pressurize a system into converging toward a *good*, rather than optimal, solution (much like the *CopyCat* model of Hofstadter and Mitchell, 1988).

Like SME, ACME is a structure matcher which compares two domain descriptions in a predicate-calculus-style representation. Tree structures in such descriptions— that is, nested predications of the form *cause(X, do(Y, …))*—are translated into a series of inhibitory and excitatory linkages in the resulting constraint network. Nodes in this network correspond to possible entity correspondences between the source and target domains (e.g., a distinct node would be allocated to the potential mapping between NETSCAPEINC and PEPSICO, and this node would inhibit the node representing a mapping between MICROSOFT and PEPSICO). Once nodes receive an initial burst of activation, constraints between nodes (which carry excitory or inhibitory activation surges) causes the activation levels of these nodes to gradually converge toward asymptotic values, whereupon the network eventually settles. An ACME network is thus deemed to have settled when a certain large proportion of its nodes have reached their asymptote. Yet while neither being maximal or optimal, ACME is slower than SME, and is certainly less systematic; this contrary result is borne out in the empirical analysis of Veale *et al.* (1996a,b).

Sapper

The Sapper framework, as described in Veale and Keane (1996, 1997), embodies a philosophy of metaphor that views the interpretation of novel metaphors as a process of conceptual *bridge-building*. From this Sapper perspective, metaphor comprehension involves the construction of new linkages, or *bridges*, between different domains of discourse; these bridges serve to bind together in memory the *analogous* correspondences that underlie a metaphor. The novelty of a metaphor may be measured then by the extent to which it adds new bridges to the structure of semantic memory. A metaphor which gives rise to a host of new bridge links—causing the semantic terrain of long-term memory to be reshaped—will be considered more novel and creative than one that adds none, or one that merely reinforces bridges that are already in place from previous metaphors.

Conceptual Bridges.

Sapper views long-term memory as a graph-structured semantic network that supports spreading activation as a core process. We distinguish two types of bridge link that can be added to this network: *dormant* bridges, which simply mark sites in memory where future, activation-carrying bridges may be built, and *active* bridges, which link two concept nodes which have previously been established as metaphoric counterparts in the context of a past metaphor. Dormant bridges do not carry activation, but merely note the potential for a new active bridge to be built between two concepts that seem potentially analogous. In contrast, active bridges *do* carry activation energy, and thus their presence reshapes the semantic terrain of memory in much the same way that new roads and bridges in the real world alter the industrial terrain by providing new possibilities for traffic flow. Extending this metaphor, dormant bridges serve as the *planning permission* for new active bridges that may be built at a future time; as planning permission is subject is certain rules, dormant bridges are created in Sapper by special rules of structural similarity that constantly organize and index memory.

The act of building a new, activation-carrying bridge can have serious ramifications for the structure of memory. As new bridges are built between domains, the number of potential activation pathways between those domains increases, and thus, so do the interference effects due to spreading activation. As new bridges allow for greater flow of activation between two domains, the connotative and structural content of one domain becomes accessible from the other. So if both domains relate to shared associations and connotations to differing degrees, the construction of new bridges between them will cause those differences to diminish. From the perspective of inference processes that rely on spreading activation as a guide, such domains will have effectively moved *closer together*, and become more truly *interactive* in the sense of Black (1962).

Dormant bridges therefore determine the possible routes along which metaphoric creativity can arise. Though by its very nature we expect creativity to involve a novel, almost anarchic combination of concepts, it is still a constrained process which stretches rather than breaks convention, for general structural constraints are what divide creativity from nonsense. (For instance, even the music of Mozart was ultimately constrained by the structure of the chromatic scale.) Sapper embodies the idea that these basic constraints on creativity can be modeled in terms of the simple rules of dormant bridge construction, since these rules require a *local consistency* in the structure of semantic memory before a dormant connection is laid down. Conceptual structures which exhibit low-level (e.g., featural) similarity possess this local consistency by virtue of coherently sharing some common conceptual structure. Dormant bridges thus represent areas of low-level similarity. A similar role for bridges can be seen in the analogy work of Hofstadter and Mitchell (1988), who also use bridge structures to record mappings between potential correspondences.

Bridge-building and the perception of similarity.

Sapper employs two distinct rules to augment long-term memory with dormant bridges — the *Triangulation Rule* and the *Squaring Rule*. Sapper does not view memory as a passive reservoir of world facts, but as a pro-active knowledge manager that actively uses these rules to recognize potentially useful similarities between different conceptual structures, and to note these similarities by laying down new dormant bridges. The greater the number of bridges that memory establishes between two domains, the greater the opportunity to bring both domains together in a future metaphor or analogy by viewing these bridges as mapping correspondences. The schematic nature of these rules is graphically demonstrated via the STARWARS example in Figure 5.

Figure 5 around Here, "Triangulation and Squaring"

The *Triangulation* rule is invoked whenever two concept nodes share a common association or superclass, as is the case with the concepts LIGHTSABRE and EXCALIBER, which share the common properties HAND-HELD and LONG, and the shared ability to cut STEEL (note that the etymology of "Excaliber" derives from "cut steel"). The triangulation rule can also be seen as a formalization of a strategy often employed in models of flexible plan recognition and generation, in which two high-level concepts can be seen as plan substitutes if they share one or more task-specific micro-features (e.g., see Hendler, 1989). For instance, an antique letter-opener can be recognized as a workable substitute for a knife in a *killing plan*, being an object that is sharp enough to accomplish the task at hand (murder), yet one which—unlike a knife—will not arouse suspicions at airport customs. The intuition behind triangulation is also implicit in the LISA model of Hummel and Holyoak (1996), in which two high-level concepts can be viewed as analogous if they relate to the same set of active low-level semantic features.

The *Squaring* rule is a *second-order constructor* that acts upon the bridges established by triangulation (whether dormant or newly active) to lay down further dormant bridges between even higher-level concepts. For example, dormant bridges laid down by the squaring rule give support to additional, higher-level bridges between LUKESKYWALKER and KINGARTHUR (because each connects to the LIGHTSABRE:EXCALIBER bridge via the same relation, CONTROL), and between StarWars and ArthurSaga (because each connects to the bridge LUKESKYWALKER: KINGARTHUR via the relation CHARACTER). In effect, Sapper employs squaring to infer high-level structural similarities from low-level perceptual similarities, by ensuring that any low-level similarities discovered by triangulation are percolated up to higher-level concepts in a structurally consistent fashion.

Triangulation and Squaring can be expressed more formally as follows:

- **Triangulation:** *If memory already contains two linkages* L_{ij} *and* L_{kj} *of semantic type L forming two sides of a triangle between the concept nodes* C_k, C_i *and* C_j, *then complete the triangle and augment memory with a new dormant bridge* B_{ik}.

- **Squaring:** *If* B_{jk} *is a conceptual bridge, and if there already exists the linkages* L_{ij} *and* L_{lk} *of the semantic type L, forming three sides of a square between the concept nodes* C_i, C_j, C_k*and* C_l, *then complete the square and augment memory with a new dormant bridge* B_{il}.

The Squaring rule is a means by which bridges can be built upon bridges, each new bridge extending the inter-domain *reach* of the last; in this way Sapper accounts for the phenomenon of *domain incongruence*—the non-literal sharing of attributes across domains (see Tourangeau and Sternberg, 1981). For instance, the incongruence between LOUD-CLOTHING and LOUD-NOISE can be explained via a squaring relation with the concepts GARISH and NOISY, which are in turn connected by triangulation via the shared properties INTENSE and UNPLEASANT. From the Sapper perspective, creative metaphor generation is thus a matter of recursively percolating local, banal similarities up to a level at which they seem to be global incongruities.

Metaphor interpretation in Sapper.

The goal of metaphoric mapping in Sapper is to find those dormant bridges connecting the tenor domain to the vehicle domain that should eventually be used as sites on which to build new active bridges. Since bridges are point-to-point connections between two concept nodes from different domains, these new bridges serve as the basic mappings or correspondences of any Sapper interpretation. But some dormant bridges, or groups of bridges, represent conflicting mappings that cannot be consistently combined. For instance, only one of the bridges DARTHVADER:MORDRED and DARTHVADER:MORGANALEFAY can contribute to a isomorphic mapping. The goal of the Sapper mechanism then is to determine the richest set of dormant bridge sites between two conceptual domains that can be consistently built upon to produce a set of mutually-consistent mappings.

The set of dormant bridges connecting the tenor and vehicle domains is determined by a simple process of spreading activation. Waves of activation energy are initiated from the central node, or *matriarch*, of each domain (e.g., in a semantic network, the node labelled SURGEON is the center of the Surgeon domain), and wherever waves from different domains meet at a dormant bridge, the pair of connected bridgeheads is considered as a possible mapping of the metaphor. Figure 6 depicts such a scenario during a search for the metaphoric basis of *Star Wars* in the *Arthurian Sagas*. Here we see that the spreading activation process has located a dormant bridge between THEFORCE and MAGIC; this bridge was constructed because THEFORCE and MAGIC are similar inasmuch as they are both types of FANTASY and MYSTICFORCE. Furthermore, the same chain of conceptual relations (such as PART, CONTROL, ATTRibute, etc.) can be used to link the tenor side of the bridge to the originating tenor node STARWARS, and the vehicle side of the bridge to the originating vehicle node ARTHURSAGA. This is a necessary constraint on the acceptability of any dormant bridge as a mapping hypothesis. It means that Sapper has identified a converging pair of isomorphic semantic pathways, which can safely be placed in analogical alignment to generate a partial interpretation of the metaphor. Because isomorphic pathways are only mapped together when connected by a common bridge, metaphor intrepretation in Sapper is driven by both literal similarity and higher-order structural constraints.

Figure 6 around Here, "Activation Flow"

As shown in Figure 7, the relational chain *character→depend→part→control* not only links the concept STARWARS to LUKESKYWALKER to REBELALLIANCE to REBEL to LASERBLASTER, but also links ARTHURSAGA to KINGARTHUR to ROUNDTABLE to WHITEKNIGHT to SWORD. In effect then, the bridge linking LASERBLASTER to SWORD (which are deemed similar because each is a deadly, hand-held weapon) acts as a *grounding*, in terms of literal similarity, for a possible partial interpretation that maps not only these two concepts together, but that also maps REBEL to WHITEKNIGHT, REBELALLIANCE to ROUNDTABLE, LUKESKYWALKER to KINGARTHUR and, ultimately, STARWARS to ARTHURSAGA.

Figure 7 around Here, "StarWars as ArthurSaga" -- Semantic Networks

Continuing with this example, Sapper considers a range of partial interpretationsfor the analysis of *STARWARS AS ARTHURSAGA*. For instance, by mapping the pathway STARWARS–*character*→OB1KENOBI–*control*→THEFORCE to ARTHURSAGA–*character*→MERLIN–*control*→MAGIC, another partial interpretation can be created around the bridge THEFORCE : MAGIC, giving support to a correspondence between OB1KENOBI and MERLIN. Similarly, the pathway STARWARS–*character*→LUKESKYWALKER–*control*→LIGHTSABRE can be mapped to ARTHURSAGA–*character*→KINGARTHUR–*control*→EXCALIBER, causing the bridged pair LIGHTSABRE and EXCALIBER to also be considered as possible correspondences. Each of these partial interpretations is consistent with the others, since none posits a competing mapping for any of the concepts involved. All three can thus be merged, to generate an interpretation with a greater number of cross-domain correspondences.

Figure 8 around Here "Star Wars as Arthur" Mappings

The Sapper algorithm.

The Sapper algorithm follows the general outline presented earlier in the context of graph isomorphism and path structures. When merging partial interpretations, Sapper uses a *seeding process* to rank interpretations according to richness (e.g., the number of distinct cross-domain mappings that each contains is a standard measure of richness). The richest interpretation is chosen as seed, and— in descending other of richness—other partial interpretations are merged with this seed if it is consistent to do so. This allows the richest subset of compatible intepretations to be combined to form an overall mapping that is both coherent (i.e., in terms of a one to one mapping of tenor and vehicle concepts) and systematic (i.e., each mapping is justified by higher-level mappings). For the current example, Sapper determines the mappings of Figure 8 as being its highest-ranked interpretation of the *STARWARS AS ARTHURSAGA* comparison. Dormant bridges that correspond to any of these mappings are subsequently awakened by Sapper, to become full carriers of activation in future metaphor interpretations. Semantic memory thus records the processing of the metaphor in a way that can be exploited by future metaphors.

Cinematic Blends and Their Analysis

The idea of pastiche as a dominant force in commercial film-making is often highlighted in films themselves. Consider for instance Robert Altman's *The Player* (1992), or the Coen brothers' *Barton Fink* (1991), films which unmercifully satirize the mainstream Hollywood creative process, by accenting the inability of studio executives to conceive of any story as anything but a blend of previous successes (e.g., "*Ghost* meets the *Manchurian Candidate*"). It is, perhaps, an uncomfortable truth that Hollywood is over-reliant on blends of proven narratives in new genre clothing. To begin with, then, let us start our review of cinematic blending with a look at some obvious film (and pre-cinematic) examples in Figure 9.

Figure 9 around Here: Cinematic Blends

The blends displayed in Figure 9, save for the case of *Star Wars* which will receive particular attention in the following section, are all rather simple cases of domain transference: the structure of an original film/narrative is mapped virtually wholesale into a new, and almost invariably more modern, setting, with the hopes of updating the story to appeal to a contemporary public. For example, the structural isomorphism between Barry Levinson's *The Natural* (1984), a modern baseball story, and the Arthurian sagas is quite remarkable. These input spaces, between which the isomorphism is established, constitute the source and target domains of the mapping, or what we conveniently termed the 'genre' and 'theme' domains in Figure 1.

A blend might selectively project from a range of different input spaces, deriving the *'glue'* for the overall binding of input elements from the image-schematic contents of generic space. In the case of cinematic blending, we perceive generic space as providing the guiding thematic and narrative conventions that control the construction of the blend. More specifically, we see this space as containing the creator's personal conceptions of story-telling, ranging from the structure of the narrative (e.g., *"make them laugh"*, *"end with a bang"*, *"must contain central opposition of characters"* etc.) to specific themes (e.g., *"must be topical"*, *"must be about the legal system"* etc.).

From the perspective of blend analysis, the topological constraints that organize a cinematic blend may be revealed using a computational model of metaphor analysis, such as SME, ACME or Sapper. Indeed, the analyses of the *The Natural* in Figure 2 and *Star Wars* in Figure 8 were produced by Sapper from semantic-network representations of each film's content. Of course, while Sapper is a useful tool in the deconstruction of a narrative into its web of original influences, it simply models an observer's subjective intuition that a narrative has been created as a blend of other narratives. It does not claim to provide objective proof of unoriginality on the part of the work's author, inasmuch as any observer can never truly know what influences are evident in a given work. Having said this, few would argue with the blend analysis of Figure 2.

Though the result is often banal, cinematic blends can sometimes transcends their underlying structural isomorphism to exhibit emergent properties of their own. For instance, *The Natural* is more than a simple redressing of an old myth in sporting garb: the juxtaposition of baseball and a popular childhood tale captures the feelings of youth, wonder and innocence that many baseball fans attribute to the game. These aesthetic considerations emerge from the film via a myriad of incidental features one associates with the Arthur mythos, such as magic, derring-do, chivalry, and battle. Ultimately, the film imbues baseball with an epic flavour, and reveals it to be an enduring cultural legacy equal in stature to the underlying Arthur myth.

Subjectivity and Divergence

Interestingly, such aesthetic considerations sometimes cause a blend to emergently support an interpretation that is greatly at odds with the source narrative. Consider for instance the case of *Forrest Gump* (1994), a film based upon a book by Winston Groom which in turn is a modern retelling of Voltaire's *Candide*. Voltaire's original text was a playfully anti-establishment work, which ridiculed the prevailing attitudes of his day, from the hypocritical morality of the church to the populist face of Leibnizian philosophy (Voltaire was himself a supporter of the less fashionable Newton). Groom's modern retelling adapts a similar tone, satirizing the sacred cows of modern American politics. However, though the film adaptation is largely faithful to the book, *Forrest Gump* the movie was unjustly hijacked by the right-wing establishment as both a tribute to conservative thinking and an antidote to un-American liberalism. But even in such cynical re-interpretations one recognizes a core feature of conceptual blending—the creation of a new conceptual space which is structurally derived from, yet inferentially independent of, its input spaces. This independence supports a form of conceptual parallax whereby one can continue to view *Candide* as an anti-establishment work, yet associate the opposite view with its derived blends.

Counterfactual Elements in Cinematic Borrowing

Before considering a specific case-study in greater detail, we conclude this overview of cinematic blending by drawing attention to the thought process that clearly originates such reworking, *counterfactualism*. For instance, as Neale (1980) notes, the suspension of disbelief—or "splitting of belief" as he terms it—that is essential to most cinematic endeavour hinges on the attitude "I know very well that this is so, and yet ...". As has been emphasized by Fauconnier and Turner, and—from a discourse perspective— Oakley (1996), counterfactual thought is a very clear manifestation of conceptual blending, and consequently, many blends (such as those discussed in this paper) exhibit a strong counterfactual feel. Whenever we say *"If I were you, I would ..."* we employ a conceptual blend of our own world view and the speaker's specific circumstances. Likewise, one can imagine the question *"If I were to remake this story for a modern audience, I would ..."* resounding throughout the corridors of the film industry. Consider, for example, the 1961 musical *West-Side Story*; the creative process behind its inception no doubt resembled the following chain of counterfactuals: *"If I were to retell Romeo and Juliet for a contemporary audience, I would use contemporary music. If I were to use Jazz, I would have to set the story at the street level. If I were to tell of a conflict between two rival street families (the Montagues and Capulets) I would have to use warring street gangs (let's call them the jets and the sharks) . And if ..."* and so on. Simple blends such as this start from an initial counterfactual premise, which has a ripple effect on the form (though rarely the narrative structure) of the film as a whole. However, basic counterfactualism accounts only for the simplest blends (which ironically, like *Westside Story*, are often the most successful). In the next section we return to *Star Wars*, an altogether a more complex example of cinematic blending that reflects specific narrative pre-conceptions on the part of its creator.

Case Analysis: Star Wars (1977)

If one wishes to appreciate the benefits reaped from successful pastiche in the cinema, one need look no further than George Lucas's *Star Wars*. At its heart, *Star Wars* is an old-fashioned fairy tale re-expressed in the lexicon of science-fiction. As we have already demonstrated in Figure 8, the narrative of *Star Wars* is remarkably similar to that of the *King Arthur* legends.

The Arthurian metaphor serves to imbue the Sci-Fi blend with a strong sense of magic, heroism, chivalry and derring-do. However, Lucas does not subscribe fully to the narrative forms preferred in the times of Sir Thomas Mallory, for though the Arthur legends begin rousingly, they end on a heavy note with the death of the main protagonist at the hands of his own son (Mordred). This is clearly not the most desirable of endings for what is intended to be a stirring crowd-pleaser of a movie, and Lucas, following his own narrative agenda, throws another popular story into the blend to yield the desired ending. The effect is a pastiche of fairy-tale and war movie, as the Sapper analysis of *STAR-WARS AS DAM BUSTERS*, illustrated in Figure 10, reveals.

Figure 10 around Here "Dam Busters"

Star Wars is thus an example of a *compositional blend* with multiple source-spaces. In stitching together a fairy-tale and a war movie to yield a narrative in the Hollywood tradition (one that allows the heroes to triumph and celebrate openly at the conclusion), Lucas employs several underlying metaphors involving a many-to-many source-target mapping. This complicates the computational perspective significantly, particularly when one recalls that one-to-one graph isomorphism is employed as the dominant complexity-reducing constraint in computational models of metaphor analysis (for example, both SME and Sapper embody strong views about *one-to-oneness*).

Narrative concerns also spur Lucas to throw yet another source structure— Kurosawa's *The Hidden Fortress* (1958)—into the blend. (Lucas is very open on this point; see Desser (1983) and Michie (1984) for a discussion of the similarities between both films.) The contribution of this source space to the blend is primarily noticeable not at the *content level*, but at a directorial level, inasmuch as it allows Lucas to tell the story through the actions of the otherwise peripheral robot figures C3PO and R2D2. These characters mirror the servant characters of Kurosawa's picture, which are also *content-peripheral* but *narrative-central* figures; we essentially see the film through their eyes. Likewise, the fortress of the title is an obvious counterpart of the DeathStar, which in the early moments of *Star Wars* is viewed as a castle in space; indeed, internally, the DeathStar is shown to contain the science-fiction equivalent of lowered bridges traversing gaping moats.

And of course, no modern crowd-pleaser is complete without the mandatory comic relief. *Star Wars* is no exception, as Lucas cleverly blends the personae of two of the screen's most memorable comics, Stan Laurel and Oliver Hardy, into his characterizations of R2D2 and C3PO. This blend is particularly successful, providing an unlikely combination of the robotic and the human. Audiences are thus pleasantly surprised to see a portrayal of robots whose bickering antics are far removed from the Hamlet-like introspection traditionally associated with the mechanized beings of cinema (for instance, the HAL of Kubrick's *2001 : A Space Odyssey* (1968), itself a character blend of the *'Zero'* computer of Godard's 1965 *Alphaville*). When C3PO moans to R2D2 that *"It's all your fault ..."* one is instantly reminded of Ollie's plaintive catch phrase *"This is another fine mess you've gotten us into, Stanley"*.

<u>Character Development and Entity-Level Pastiche</u>

Aristotle argues in his *Poetics* (see Hutton, 1982) for the importance of plot: even characterization, he advises, is expressible via plot. In semiotic terms, characters whose personae are developed entirely through plot are traditionally termed *'actants'* (e.g., see Palmer, 1987). But however prevalent the use of actants in the literature of Aristotle's time, the actant is decidedly under-employed in today's image-fueled cinema. Movie characters are often chosen not as points through which an author arcs the lines of plot, but as statements in themselves. Indeed, both actors and directors often have specific conceptualizations of a character which are largely peripheral to the plot, and we can see this in the way film characters are often constructed as pastiches of other resonant cinema entities. In *Star Wars,* for instance, the character of Han Solo corresponds to the heroic and clean-cut Lancelot in the Arthurian element of the blend, but is also presented as an altogether less chivalrous gun-slinging outlaw cowboy (seen drinking in a space-age saloon; presumably, the hairy Chewbacca is his equivalent of Roy Rogers' faithful horse Trigger), a pirate and smuggler (where the Millennium Falcon is his *ship*), and a mercenary. Each of these alternate characterizations expresses an attitude which is largely independent of the narrative flow, but which contributes hugely to our appreciation of the character. Likewise, the character of Darth Vader is a pastiche of the Black Knight (e.g., Mordred), that classic dark figure of fairy tales, and the raspingly villainous character portrayed by Jack Palance in *Shane* (1953). Again, it is hardly a matter of plot that Vader dresses in black and sounds very much like a respiratory machine, but the effect is undeniable: Vader is a classic *black hat* character that simply resonates with evil.

Non-animate characters may also be pastiches; we have already noted how the robots C3PO and R2D2 are both blends of the servant figures in Kurosawa's *The Hidden Fortress* and the bickering Stan and Ollie. Likewise, even the DeathStar is a important pastiche-character in the film; initially depicted as a floating castle in space, the DeathStar is later conceptualized as a form of huge atomic bomb (indeed, the inspiration for President Reagan's demented SDI program, tellingly but tactlessly christened *Star Wars*), and finally, as an artifact of imperial industrial strength which mirrors the role of the Ruhr dam in 1954's *The Dam Busters*. Like the Ruhr dam, the DeathStar is shown to have a fatal but difficult to exploit flaw; only a well-aimed projectile (whether a photon torpedo or a bouncing bomb) can penetrate this weak-spot and destroy the mighty edifice.

When we come to analyzing a blend, it is thus necessary to give equal consideration to both the entities and the actions of the narrative. This is not only true of a domain such as cinematic pastiche, but is apparent even in the psychological work of Freud. Psychiatric diagnosis in the Freudian manner, based either upon a report of dreams or upon free-associative couch sessions, is driven by a process of interpretation whereby latent meaning is given to the manifest concepts reported by the patient. This process, which curiously has much in common with the act of film criticism and interpretation (indeed, Metz (1972) is an influential critic so openly indebted to Freudianism as to view all interest in cinematic technique as a sublimated sexual fetish), often focuses first upon the manifest objects which are reported. For instance, the manifest objects *comb*, *mirror*, *water*, and of course *cigar* all have latent Freudian counterparts in the sexual domain. Once the analyst determines the latent objects of a dream, the actions of the dream can be interpreted, revealing the basis of the patient's psychological problem. Freud's theory of dream analysis is discussed in detail in Richards (1976).

Even when an author's point is expressed via cinematic action, it is often the objects of *mise-en-scène* upon which these actions operate that give the point its visual power. For instance, when in Chaplin's *The Gold Rush* (1925) a starving tramp is forced to eat his own boot for nourishment, it is not only Chaplin's comedic skills as a mime, but the physical resemblances between shoe-laces and spaghetti, that carry the scene. Likewise, in Kubrick's *2001: A Space Odyssey*, the *'match-cut'* between a falling bone and a tumbling space-station carries the film's message—human evolution via technological advance—for the most part due to the shared visual and cultural properties of the objects concerned. Ultimately then, a theory must not discount the role of entities and their properties in a theory of cinematic interpretation of any kind, even one that is primarily fixated on action rather than appearance.

Computational Treatment of Blend Entities

But do such considerations have computational ramifications as well? Clearly, a model of blend analysis such as Sapper must be capable of deriving mappings from the representations of individuals (e.g., associational, partonomic, taxonomic and other inter-concept relations) as well as events (e.g., nested causal predications). Importantly, a comparative evaluation of Sapper, SME, and ACME described in Veale *et al.* (1995; 1996a,b) reveals that Sapper is equally adept at mapping structures representing both plot-driven narratives (i.e., those containing nested causal structures) and character-driven narratives (those that emphasise the traits of individuals and the control relations between them). However, the same experiments show SME and ACME to be better suited to plot-driven rather than character-driven narratives, for they lack a suitable perspective on structure to keep the space of possible interpretations in check.

Since cinematic blends can combine elements of both character and narrative, character-level considerations should not be relegated to a peripheral status when considering the nature of the mapping. For even in primarily plot-driven narratives, a great deal of fusion, or *sub-blending*, may occur within each of the input spaces before these spaces are blended to provide the final result. In *Star Wars* for instance, the character of Han Solo is first created as a blend of various characters in the source domain of romantic adventure, possibly using Lancelot as a pivotal entity, and then folded into the *STARWARS AS ARTHURIAN-SAGA* blend using Lancelot as an entry-point. To use the terms of Fauconnier and Turner, it seems *fusing of counterparts* occurs not only in the blend space, but in the source (and possibly the target) space also. This not only has ramifications for the complexity of the blend process, and computational models thereof—which must now be conceived as involving many-to-many mappings—but also for the structure of the Fauconnier and Turner model.

Blending Narrative Spaces

Having explored what blending can tell us about cinematic pastiche, we can now consider what cinema can tell us about blending. For instance, cinema proves to be an excellent domain in which to elucidate the nature of generic space, and its coordinating role in metaphor blending. Additionally, the prevalence of many-to-many mappings in this domain prompts us to reconsider the interaction between source, target and blend spaces, and to find the Fauconnier and Turner approach in need of elaboration in this respect. Augmentations to this basic model are thus proposed, which allow us to view a conceptual blend as a dynamic rather than static entity.

The Generics of Narrative Space

In the literature of film criticism there is much debate as to what constitutes the ‘genre’ of a film (e.g., see Neale 1980 for a comparison of the prevailing views). However, perhaps the least contentious definition of ‘genre’ is given by the critic Tom Ryall:

> The master image for genre criticism is the triangle composed of artist/ film/audience. Genres may be defined as patterns/forms/styles/structures which transcend individual films, and which supervise both their construction by the film maker, and their reading by an audience. (Ryall, 1980).

Unsurprisingly, this high-level 'supervisory constructive role' of genre accords well with the conception of generic space as found in the work of Fauconnier and Turner. As previously suggested then, we perceive a cinematic generic space to be the codification of genre-related narrative conventions and preferences that are employed by a creator (writer, director, etc.) in the formulation of a blend. These preferences can range from the very abstract to the very specific, defining a creator's work as either startlingly innovative or mundanely predictable. Consider for example the following set of narrative conventions employed by some popular writers and film makers:

Michael Crichton: Hubristic scientists meddle with nature, under-estimating the potential dangers of their technologies. Inevitably, this hubris leads to large-scale disaster, with man/science achieving only a temporary reprieve. The scientific backbone of the book/film must be highly topical, usually hot from the pages of Time magazine. [Predictable: Westworld, The Andromeda Strain, Jurassic Park].

Philip K. Dick: Nothing is what it seems in an atavistic future, where science can alter a man's memories, thoughts and feelings. Technology has produced a soulless existence, where machines are intrinsically amoral (and often evil) due to a lack of human spirituality. [Unpredictable: Do Android's Dream of Electric Sheep? (filmed as Bladerunner), We can Remember it for You Wholesale (filmed as Total Recall)]

John Grisham: A new idealistic lawyer, who is shown to be initially naive yet a quick learner, becomes a pawn in a dangerous game of legal cat and mouse. However, brains and an unshakable belief in the sanctity of justice allows him/her to triumph over daunting adversaries. [Predictable: The Firm, The Pelican Brief, The Client]

Umberto Eco: An unexamined life is a life only half lived. Philosophy (and especially semiotics) is more than a dry academic subject, but the basis of everyday life. The signs are there to be found: it is simply required that the protagonist determine their significance. [Unpredictable: The Name of the Rose, Foucault's Pendulum]

From this small sampling, we see that the more innovative and unpredictable creators employ an abstract generic space which simply specifies the general theme of their work, while the most predictable creators use generic space to additionally impose a rigid, template-like narrative and thematic structure.

The cognitive structures that seem to best fit these generic constraints are the *Memory Organization Packets* (MOPs) of Schank (1975), the *Thematic Abstraction Units* (TAUs) of Dyer (1983) and the *Plot Units* of Lehnert and Loiselle (1983). MOPs are conceived as a generalized organizer of conceptual structures such as Schankian scripts; for instance, we might posit a *VISIT HEALTHCARE PROFESSIONAL* MOP to capture the generics of visiting a doctor, dentist, chiropractor, and so on. However, TAUs seem much more suited to the domain at hand—cinematic narrative—inasmuch as they are designed to capture the essentials of story telling, such as plot twists, expectation failures, reversals of fortune, and so on. Dyer (1983) conceptualizes TAUs mainly as proverbial schemas that express a pithy narrative structure, such as *THE POT CALLING THE KETTLE BLACK*, *A STITCH IN TIME SAVES NINE*, and *LOOK BEFORE YOU LEAP*.

A related cognitive structure is the plot unit, which tracks the dynamics of the goals and *affective states* of characters in a narrative, and thus captures an understanding of a story in terms of who does what to whom and why. Plot units form a skeletal representation that sketches the movements of a story in broad positive and negative terms (much like the *Conceptual Scaffolding* representation of Veale and Keane 1992a,b), while nevertheless being expressive enough to capture such universal plot developments as *REVERSAL OF FORTUNE*, *FORTUITOUS PROBLEM RESOLUTION*, *LOSS*, *HONOURED REQUEST*, *PYRRHIC VICTORY* and *FLEETING SUCCESS*.

We propose that, taken together, TAUs and plot units provide the necessary structural vocabulary to describe the generic space in cinematic blending. From this perspective, predictable writers such as Crichton and Grisham employ generic spaces containing well developed TAUs, such as *SCIENCE VERSUS NATURE* or *IDEALISM VERSUS GREED*, that are associated with plot unit structures of considerable specificity. In contrast, Eco and Dick employ abstract TAUs, such as *LIFE AS SEMIOTIC INQUIRY* or *SOULLESS SCIENCE*, with exhibit minimal commitment to specific plot unit structures.

To conclude this discussion, we should note that generic space can act as more than a simple selectional constraint on the source and target spaces. Often, the plot conventions employed by an author will act as a prompt to reshape the contents of the source domain to suit the structure imposed by generic space. We have already seen how specific narrative preferences prompted George Lucas to depart from the ending suggested by the Arthurian metaphor, and to augment the *Star Wars* blend with another story, *The Dam Busters*, that would provide the desired finale. Likewise for the sequel, *The Empire Strikes Back* (1980), Lucas preserves the Freudian father:son relationship between Arthur and Mordred, but turns the relation on its head: Vader is now seen to be Luke's father. This is necessary if the Arthur myth is to conform to Lucas's story-telling conventions—attempted patricide is excusable only if the father is perceived to be evil.

Director John Boorman exhibits similar narrative sensibilities in his 1981 version of the Arthur legend, *Excalibur*. The film concludes with Arthur and Mordred dispatching one another; Mordred spears Arthur, but the resilient King pulls himself along the spear to reach his son and kill him with Excalibur. In contrast, Mallory's original portrays precisely the reverse: Arthur spears Mordred, while it is Mordred that dispatches Arthur with Excalibur. Unsurprisingly, Boorman's version is clearly the preferable of the two in crowd-pleasing terms. It is also interesting to note the debt that Boorman owes to *Star Wars*; in another exercise of Hollywood convention, and quite at odds with Mallory, his version of the Arthur saga chooses to have Lancelot return at the last moment to help Arthur in his battle against Mordred. Reminiscent of Han Solo's last minute return to aid Luke against Vader, we see here evidence of the primacy of generic space over source material in constructing cinematic blends (see Brode (1990) for such an interpretation of Boorman's motives).

<u>The Dynamics of Blended Space</u>

As argued in relation to *Star Wars*, the entities over which a narrative structure may range in a given cinematic blend may also be character blends in themselves. This complicates the mapping between target and source domains, for we can no longer assume it to be an isomorphic, one to one mapping. However, if we allow that a fusion of characters may occur within each domain (e.g., HANSOLO = LANCELOT + COWBOY + PIRATE + SMUGGLER + MERCENARY) before the narrative blend occurs, the mapping can be transformed from a loose many-to-many *homomorphism* to a rigid one-to-one isomorphism whose elements are not characters, but collections of characters.

Figure 11 around Here "Character Blends"

Unfortunately, this approach—illustrated in Figure 11—only holds under a static viewing of the blend process. For while an uncomplicated character like Forrest Gump may remain a relatively constant mix of Candide and southern charm throughout a film, the blend composition of more resonant characters often shifts dynamically in the course of narrative flow. Indeed, this shift is often the main focus of the narrative. Consider, for instance, the character of young Alex in Anthony Burgess's *A Clockwork Orange*, a violent young prole who, through the course of the narrative, develops into a responsible member of society (ironically, this ending is not used in Stanley Kubrick's 1971 film version). This maturation process is cleverly mirrored by Alex's changing taste in classical music, which shifts from a naïve delight in the obvious charms of Beethoven's louder symphonies to an appreciation of the subtleties of Mozart. Whittock (1990) refers to this form of metaphoric parallelism in narrative as *'chiming'*. On a less literary level, the character of Han Solo in Star Wars shifts from the status of greedy mercenary to lovable rogue, allowing him to occupy one vertex in the traditional love triangle that exists between Luke and Princess Leia, and thereby providing a rather clichéd yet entertaining romantic sub-plot. This developmental view of character representation is reflected also in modern theories of knowledge representation; the Cyc project, for instance (see Lenat and Guha, 1990), models living entities as dynamic processes, which are in turn represented as collections of complementary aspectual frames (e.g., *Fred_on_May_1st*, *Fred_going_to_Work*, etc.).

In effect then, if a cinematic pastiche is to be viewed in terms of a static mapping, the corresponding blend must be conceived as a series of sequential static blends, in which the balance of character-level pastiche is constantly shifting. Yet these static blends all derive not from the infinity of potential mappings available, but from an original collection of pastiche possibilities which are fixed in the creator’s mind. Thus, we can view this space of limited possibilities as forming a dynamic blend, from which a series of sequential static blends are derived. This dynamic, extended view of the Fauconnier and Turner model is illustrated in Figure 12.

Figure 12 around Here, "Extended Model"

Under this extended perspective, dynamic blend space is conceived as a workspace from which individually instantiated spaces of the blend are generated. By separating this dynamic matrix space from the series of instantiated static spaces, we allow the blend to be appreciated both as a summary whole or as a sequential composite; the terms *summary* and *sequential* are used here in the sense of Langacker (1991), whose *cognitive grammar* theory describes the conceptualization of verbs and their morphological derivatives as a scanning process. From a perspective informed by Langacker’s work, a blend can be appreciated dynamically via either a *sequential scan* through its temporally-ordered static states, or via a *summary impression* obtained by conflating the mappings inherent in dynamic workspace into a single whole. The interpretations provided by Sapper throughout this paper (such as those of Figures 2 and 8) are of this latter summary variety. The sequential scan required by a truly dynamic interpretation would require the repeated application of Sapper, to different components of a narrative representation that had been temporally partitioned (in much the same way that plays are temporally partitioned into different acts).

Pastiche: A Computational Model of Blending

Sapper accounts for the role of generic space in mapping by positing the existence of special structural rules – Triangulation and Squaring – that determine the common semantic ground upon which the mapping is to be founded. In effect, these rules analyse the input conceptual structures of a metaphor or blend and determine the perceptual commonalities between them. Upon these low-level commonalities the Squaring rule constructs a consistent latticework of bridges that leverages this perceptual similarity into a higher, structural level. The shared concepts that allow triangulation and squaring to take place can thus be seen as the generic terms that relate both inputs and dictate the general form of the mapping. In effect, the triangulation and squaring rules construct the generic space for a particular mapping.

In this section we build upon the account provided by Sapper to describe a complete framework, called Pastiche, that accounts for the range of narrative-blending phenomena discussed in the paper.

Generic-Space / Source-Space Interaction

Recalling our earlier discussion of generic space, certain author-specific thematic constraints are projected from this space onto the source domain, thereby filtering out and highlighting a structural basis for a given blend. A computational model of generic-space/source-space interaction is in essence then a model of *analog retrieval*, inasmuch as a structure is to be extracted from the source domain which exhibits certain semantic/structural properties. The analogy literature is divided between two possible models of analog retrieval, the ARCS *(Analog Retrieval by Constraint Satisfaction*) model of Thagard, Holyoak, Nelson and Gochfeld (1990), and the MAC/*FAC (Many Are Called but Few Are Chosen)* model of Law, Forbus and Gentner (1994). ARCS is the retrieval companion piece to the ACME model of metaphor interpretation, and employs a connectionist model of constraint satisfaction to select the best matching analog from a large pool of alternate choices. MAC/FAC in turn is the retrieval counterpart of the SME model, and employs a simple two-level filter mechanism, comprising a fast course-grain phase and a slower fine-grain phase to again select the best matching analog from a large memory pool of choices.

The types of retrieval one generally senses at work in cinematic pastiche can range from the unstructured to the structured, employing anything from lists of flat properties to intricate narrative structures as recall cues. For example, the retrieval cues of Figure 13 can be used to probe the domain of *Star Wars* for possible analog narratives.

Figure 13 around Here "Retrieval Cues"

This probing is a form of property-driven retrieval that is readily modelled as a spreading activation process. As shown in Figure 13, two candidate analogs distinguish themselves from the rest of the field, given the retrieval cues used by the spreading activation: the *Arthurian Saga* and *The Dam Busters*. Because neither source-space analog satisfies every author requirement in this instance (e.g., in the way that *Romeo and Juliet* completely satisfies the goals of *West-Side Story*), it is necessary to fold the compatible elements of each partial solution together in a coherent fashion. The Sapper mechanism is very much suited to this task, as shown in Figure 14.

Figure 14 around Here, "Arthur and Dam Busters"

As can be seen, both analog structures clearly blend together, with the 1-to-1 mapping theory of the analysis in Figure 14 revealing the seams along which the narrative structures of each story have been be stitched together. With this blend as a basis, the story concept of Kurosawa's *The Hidden Fortress* can similarly be folded into the narrative, to produce an overall plot that exhibits the required perspectival elements.

Modeling the Interaction of Source and Target Spaces

In contrast to the process of metaphor interpretation, which concerns a comparison of two structured conceptual structures (such as *ARTHUR-SAGA* and *THE-NATURAL* in Figure 2), a cinematic blend will frequently *not* involve a highly structured target space. Often, the target space will simply be a set of properties reflecting a mood or atmosphere (i.e., a *mise-en-scène*) describing the desired genre of the blend. For example, in the case of *Star Wars*, the dominant constraint on the target space is that it refer only to concepts from the science-fiction genre. For this reason, the newly constructed narrative blend of the *Arthur Saga*, *The Dam Busters* and *The Hidden Fortress* cannot be mapped into the target domain wholesale, as there exists no corresponding structure in the science-fiction genre with which to match it; this is the mark of originality in a blend like *Star Wars*. Rather, each element of the narrative needs to be individually mapped into the target domain, before the set of target counterparts can be reassembled to produce the blend (this is why Kael (1980) refers to *Star Wars* as *'an assemblage of spare parts'*). That is, concepts such as SWORD, LANCELOT, LANCASTERBOMBER and RUHRDAM are mapped into the Sci-Fi domain so their science fiction counterparts can be assembled into a science-fiction narrative.

For instance, the concept LANCELOT might be transferred into the target domain by matching it with a Sci-Fi counterpart such as FLASHGORDON or BUCKROGERS. Likewise, MERLIN may be mapped onto DR-ZARKOFF in the target space, while GUINNEVERE finds a likely counterpart in either DALEARDEN or WILMADEERING. This domain transference thus exploits existing role-models in the target domain, which in turn facilitates further visualization and inference within the blend. Thus, since the Lancaster bombers of *The Dam Busters* are obvious counterparts of spaceships in the Sci-Fi domain, this prompts the inference that ariel dogfights will occur not in the air, but in the vacuum of outer space. Genre expectations can temper such inferences, causing elements of the source space to be carried over to the target domain unchanged, even though it may be logically incongruous to do so. *Star Wars*, for instance, is so controlled by the genre constraints of aerial combat that its space ships can be seen and heard to make banking turns in a vacuum (see Krauss (1995) for a discussion of the many ways, subtle or otherwise, in which science defers to plot in this genre).

In contrast, transporting a concept such as EXCALIBER into the Sci-Fi domain asks more of a viewer’s imagination. Since there is no pre-existing concept that accurately represents the idea of a science-fiction sword, some decomposition is required. Like the narrative in which it appears, Excaliber must be disassembled in its source domain (i.e., into BLADE and HILT), and transported piece by piece into the target domain, where it can be reassembled into a Sci-Fi equivalent. Since LASER is a good scientific counterpart for BLADE, a good counterpart for SWORD is a portable laser with a handle.

Blend Lexicalization

Just as the name "light sabre" is given to the blended concept of a laser with a hilt, each element of the source that is transported into the target domain may need to renamed, in a concretion process we term *blend lexicalization*. For example, in *Star Wars* the blend of LANCELOT and FLASHGORDON is labeled HANSOLO, that of GUINNEVERE and DALEARDEN is labeled PRINCESSLEIA, and that of MERLIN and DR-ZARKOFF is labeled OB1KENOBI. Lexicalization serves to free a blended space from its logical (though not conceptual) ties to the source and target spaces, allowing the blend to exhibit its own logical idiosyncrasies. It means that the constituent concepts in the blend can be construed to work differently from those they originate from, so that any changes to our understanding of these concepts will leave their origins unaltered. Thus, XWINGFIGHTER (the STARWARS counterpart of the LANCASTERBOMBER central to the *Dam Busters* narrative) is allowed to make audible banking turns in a vacuum, while real fighter planes and spacecraft are not. In general then, the character fusions of a cinematic blend should be understood not as finished products, but as *plastic* points of departure, which may be modified as the blend is dynamically unfolded.

Structure Retrieval for Space Interaction

A computational model of this transference process is essentially a structure retrieval mechanism, possibly resembling either the ARCS or MAC/FAC models. As we have seen, however, the retrieval process is also complicated by the need to decompose the source structure when no target counterpart is available (as in the case of *EXCALIBER AS LIGHTSABRE*), so as to construct a target mapping from sub-parts which do possess counterparts in the target. Rather than modify an existing model such as ARCS or MAC/FAC to accommodate this type of compositional retrieval, we instead present a novel approach to the problem, one which is a natural counterpart to the Sapper model.

The model described here, named Scout, is a spreading-activation model which exploits Sapper's use of bridge links between domains. Given a source concept for which a target-domain counterpart is desired, Scout employs spreading activation to seek out all semantic pathways in the given tenor domain that have isomorphs in another domain. It is led to explore these potential isomorphs by following conceptual bridges from the tenor domain into other domains, whereupon it 'unfolds' the path it has followed so far to find a vehicle concept that occupies the same relative position in its domain as the tenor does in its own. Scout is effectively a less-constrained version of the Sapper algorithm, inasmuch as it works with a given tenor domain, but does not possess advance knowledge of the vehicle domain.

Figure 15 around Here: Scout example

This situation is illustrated in Figure 15, in which a counterpart for the film/concept THEGHOSTANDTHEDARKNESS (henceforth TGATD) is sought. Note how the path TGATD—*star*→VALKILMER—*depend*→MICHAELDOUGLAS leads to a bridge between the concepts MICHAELDOUGLAS and ROBERTSHAW: these concepts are triangulated since both play irascible, highly-experienced hunters in their respective films. This path from TGATD can now be unfolded via the corresponding pathway ROBERTSHAW←*depend*—ROYSCHIEDER ←*star*— JAWS to pinpoint the concept JAWS as possible inspiration for William Goldman's script of TGATD. In reality, Goldman's debt is so clear that the film's director is obliged to make light of the pastiche with several satirical touches. The most memorable of these is a scene in which a lion approaches a small community through the swirling, wave-like grasses of the savannah, with tail held erect above the grass-top—like the dorsal fin of a great white shark—to the accompaniment of a throbbing, Jaws-like overture.

Working from the opposite perspective, let us that suppose one starts with the JAWS narrative, and wishes to create an analogous narrative in another domain (e.g., *'I want to make a* *safari version of this story'*). Because Scout employs spreading activation, it can be primed to seek out appropriate target-domain counterparts for each element in the JAWS narrative. For instance, if spreading activation is initiated from the concept SAFARI, this will bias Scout's search for a target counterpart toward this particular domain. Thus, concepts which relate to SAFARI by some conceptual path will be favoured over others than do not. Scout would thus prefer LION as a counterpart for SHARK over either SUBMARINE or WHALE (which look more similar). Since Scout is effectively a structure-mapper, concepts associated with LION that are necessary for the narrative would also be mapped consistently: thus, Scout would prefer SAVANNAH-GRASSLANDS as a counterpart for ATLANTICOCEAN, since this mapping is consistent with that of SHARK to LION.

It is important to note that Scout is a tractable model of structure-retrieval. Because Scout only investigates domains that can be reached via bridges that have been laid down by the triangulation and squaring rules, it avoids exhaustive search of memory while taking practical measures to partially guarantee the coherence of any suggested mappings. Scout simply never enters those domains which are not linked by bridges (and thus, some form of similarity) to the given tenor domain.

Tying It All Together: Combining Sapper and Scout

We propose that a combination of the Sapper and Scout models provides an adequate computational basis for modelling the processes of conceptual blending. The relationship of these models to the Fauconnier and Turner many-space framework is illustrated in Figure 16. Note how this computational perspective upon conceptual blending reserves a central position for metaphor in cognition, since blending is here organized as a multi-space extension of basic metaphoric processing. This view of metaphor as a basic cognitive mechanism for the juxtaposition of two knowledge structures, or *matrices*, thus re-interprets Koestler's notion of *bisociation* as a generic combinator in human creativity in terms of recent advances in metaphor research.

Figure 16 Around Here: Pastiche framework

Summary, Conclusions and Future Directions

This paper has discussed the issues of conceptual blending relative to a creative domain in which this cognitive process is pivotal — the Hollywood film industry. The nature of pastiche in this domain has served to both elucidate and expand the mechanics of the Fauconnier and Turner model of blending, explicating the rather abstract workings of generic space while also pointing toward the need to augment their currently static conceptualization of blend space. We view the current static nature of the model not as a design flaw, but as an inchoative feature of a nascent, evolving theory which this paper seeks to advance an additional step. For this reason a computational model of conceptual blending, named Pastiche, has also been presented, and its mechanics explained in terms of existing models of metaphor processing, the Sapper and Scout systems of Veale and Keane (1997).

Algorithmic Realization

More specifically, by drawing upon examples from cinematic pastiche, this paper has argued that a computational model of conceptual blending can be constructed from a model of both metaphor interpretation (Sapper) and a complementary model of metaphor creation (Scout). The reader may consider it apt that such a model of pastiche is itself a parsimonious assemblage of cognitive spare parts, scavenged from the metaphor processing faculty. From a computational perspective, we have argued conceptual blending to be a reification of the metaphor comprehension faculty, in which mechanisms such as Sapper and Scout provide the mediating functions between different spaces. More specifically, we have shown how Sapper can mediate both between the source and target input spaces, and between the generic and source spaces, while showing how Scout can mediate between the source and target spaces.

Hermeneutics and Post-Structuralist Thought

This paper has stressed three common aspects of these appositional phenomena: i) the deconstructive possibilities inherent in conceptual appositions; ii) the subjectivity of particular frame deconstructions of these appositions; and iii) the role of consensus world knowledge, and the structural constraints imposed upon it (e.g., as in Triangulation and Squaring), in the generation of these deconstructions. From these perspectives, the process of blend analysis clearly has much in common with the process of *textual hermeneutics,* a pursuit concerning the human understanding and interpretation of written texts, and one which is thus particularly dependent upon a solid theory of metaphor (e.g., see Ricoeur, 1974). Though there are many strands to hermeneutic thought (such as the *methodological*, *philosophical*, *critical* and *phenomenological* schools), the hermeneutic process can be summarized broadly as follows: understanding of a particular text may require an understanding of the background and social context (or *effective history*) of the author, the relevance of the text to the reader, and the reader's own effective history. True understanding thus requires an understanding of how these different, highly subjective *spaces*, interact, and how they may be successively separated and re-integrated in a new context.

As a clear example of the necessity of hermeneutic *space separation* in text interpretation, consider the following issue of scientific history: for many years students of Isaac Newton have found it rather anomalous that the father of modern mechanics should also have had such an embarrassingly keen interest in the discredited study of alchemy and natural magic. Scholars have attributed this interest to causes as varied as senility and even mercury poisoning, but an examination of his surviving manuscripts demonstrates that Newton's interests in alchemy were contemporaneous with those in mechanics, and not a fad of later life. In fact, the sharp distinction we draw between science and magic today was not nearly as sharp in Newton's day. Furthermore, it seems likely that without an interest in natural magic Newton might never have proposed such occult principles as *attraction at a distance,* a principle which underlies his greatest achievements. Without an understanding then of Newton's background and social context, a proper interpretation of his scientific writings (a blend of science and magic) in not possible (see Flavel *et al*. 1988 for an overview of Newton's work).

We suggest that an algorithmic model of blending such as Pastiche will permit a hermeneutic model to perform this successive separation and reintegration of spaces, as has been demonstrated (in embryo) with the various film deconstructions that illustrate this paper. Pastiche thus represents a hermeneutics-centered approach to Artificial Intelligence (AI) as defined by Mallery, Hurwitz and Duffy (1986). These authors consider various *counter-AI* arguments that have been grounded in hermeneutic thought, such as those of Dreyfus (1972/1992) and Winograd and Flores (1986), and while accepting that these arguments do indeed establish AI to be a particularly difficult endeavor, nevertheless propose that theories of thought which stress the role of effective histories in human decision making are amenable to computational modeling. The current work forms an additional strand to this pro-AI hermeneutic endeavor.

Implementation Notes

We conclude our discussion with a brief note on implementation status. Currently, both the Sapper and Scout models have been implemented (in Prolog), and their implementation has been the source of the various metaphor analyses in this paper. The data upon which these interpretations have been based is available on the world wide web at *http://www.compapp.dcu.ie/~tonyv/metaphor.html*. A Prolog implementation of Sapper and Scout is likewise available from this site.

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FIGURE CAPTIONS

Figure 1: A schematic view of the Blended Space Model of Fauconnier and Turner. Under the structural constraint of Generic Space, a structure in Space 1 is blended with a structure from space 2 to create a more elaborate structure in the Output Space. Solid dots represent entities in each domain, solid lines represent relations between those entities, while dashed lines represent mappings between entities of different spaces.

Figure 2: Structural Basis for the metaphor "The Natural" is the "Arthur Saga".

Figure 3: The Market Dynamics between Microsoft and NetscapeInc (top) and between CocaCola and PepsiCo (bottom). Semantic Relations marked with a • indicate pejorative (as opposed to strictly logical) negation; thus, Microsoft-•affect→NetscapeInc means that Microsoft negatively affects NetscapeInc.

Figure 4: Interpretation of the cinematic analogy 'Star Wars is the Wizard of Oz'.

Figure 5: The Triangulation Rule (i) and the Squaring Rule (ii) augment memory with additional dormant bridges (shown as dashed lines), precompiled pathways that may later be used to form cross-domain analog bindings. Note that in (ii), the triangulations that provide grist to the Squaring rule are de-emphasized in gray.

Figure 6: A dormant bridge-link between the concepts TheForce and MAGIC is deemed to provide a plausible match hypothesis in the metaphor STARWARS AS ARTHURSAGA when it acts a domain cross-over for two competing waves of activation originating from these matriarch nodes.

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Figure 9: Clear cases of narrative blending.

Figure 10: Structural Basis for the Metaphor "Star Wars "is "The Dam Busters".

Figure 11: A compositional view of the possibilities which are inherent in the source and target spaces of a blend. Circles within circles represent pre-blend fusions of entities before the larger input spaces are themselves fused.

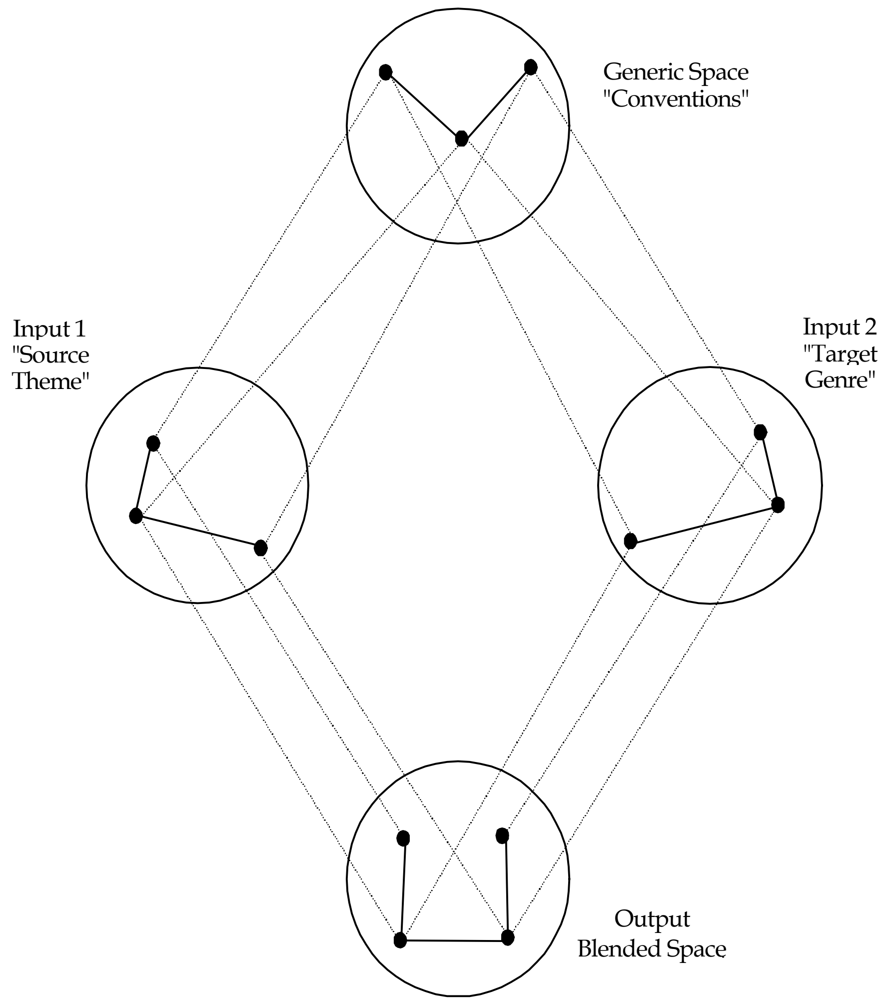
Figure 12: A revised blended space model which accounts for the dynamic nature of complex narrative blends

Figure 13: Various Retrieval Cues for Unstructured Recall of Narratives.

Figure 14: A Tentative Blending of the Arthur and Dambusters Analogs.

Figure 15: Scout — the retrieval component of Sapper— searches for a potential vehicle for the tenor concept TheGhostAndTheDarkness (a conceptual representation of the film of the same name). This figure illustrates that Scout has found seven different bridge-based pathways from the node TheGhostAndTheDarkness to the node Jaws, establishing a strong case for considering both as analogous.

Figure 16: Sapper and Scout provide the computational workings of Pastiche, a model of conceptual blending, by mediating the interaction between different spaces.



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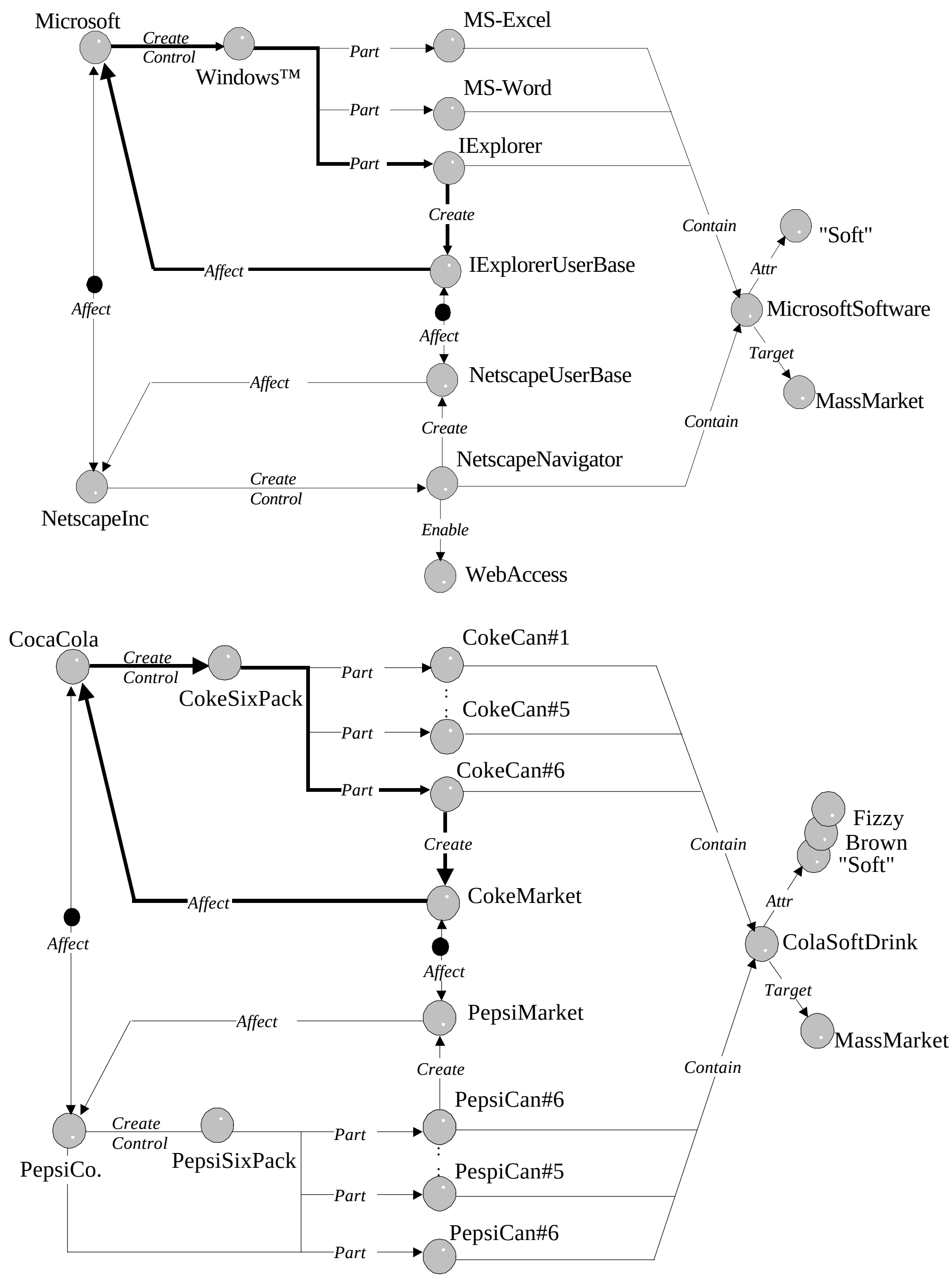
If **King-Arthur-Saga** is like **The-Natural**

Then **Middle-Ages** is like **The-Twenties**
and **King-Arthur** is like **Robert-Redford**
and **Guinnevere** is like **Glenn-Close**
and **Merlin** is like **Wilford-Brimley**
and **Morgana-Lefay** is like **Kim-Bassinger**
and **Magicked-Stone** is like **Lightning-Struck-Tree**
and **Excalibur** is like **Wonderboy-Baseball-Bat**
and **Another-Excalibur** is like **Another-Baseball-Bat**
and **Albion** is like **National-Baseball-League**
and **Round-Table** is like **Baseball-Diamond**
and **Camelot** is like **Knights-Baseball-Stadium**
and **Knight-Of-Round-Table** is like **Knight-Player**
and **Knights-Of-Round-Table** is like **Knights-Baseball-Team**
and **Suit-Of-Armour** is like **Baseball-Uniform**
and **Grail** is like **League-Pennant**
and **Secret-Of-Grail** is like **Batting-Average**
and **Grail-Quest** is like **League-Pennant-Drive**
and **Advise-Merlin-Arthur** is like **Advise-Wilford-Redford**
and **Obtain-Arthur-Excalibur** is like **Obtain-Redford-Baseball-Bat**
and **Become-Arthur-King** is like **Become-Redford-Baseball-Champion**
Build-Arthur-Camelot is like **Revitalise-Redford-Knights-Team**
and **Marry-Arthur-Guinnevere** is like **Marry-Redford-Glenn-Close**
and **Break-Arthur-Excalibur** is like **Break-Redford-Baseball-Bat**
and **Obtain-Arthur-Another-Excalibur** is like
Obtain-Redford-Another-Baseball-Bat
and **Seduce-Morgana-Arthur** is like **Seduce-Bassinger-Redford**
and **Lose-Arthur-Grail-Secret** is like **Lose-Redford-Batting-Average**
and **Initiate-Arthur-Grail-Quest** is like **Initiate-Redford-Pennant-Drive**
and **Ditch-Arthur-Morgana** is like **Ditch-Redford-Bassinger**
and **Obtain-Arthur-Grail** is like **Win-Knights-Pennant**
and **Regain-Arthur-Grail-Secret** is like
Regain-Redford-Batting-Average

Figure 2: Structural Basis for the metaphor "The Natural" is the "Arthur Saga".



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If **Star-Wars** is like **The-Wizard-of-Oz**

Then **Luke-Skywalker** is like **Dorothy**

and **Tatooine** is like **Kansas**

and **Storm-Trooper-Raid** is like **The-Tornado**

and **Storm-Trooper** is like **A-Money**

and **Jawa** is like **Munchkin**

and **Obi-Wan-Kenobi** is like **Glinda**

and **The-Force** is like **Ruby-Slippers**

and **Darth-Vader** is like **Wicked-Witch-of-the-West**

and **C3PO** is like **Tin-Man**

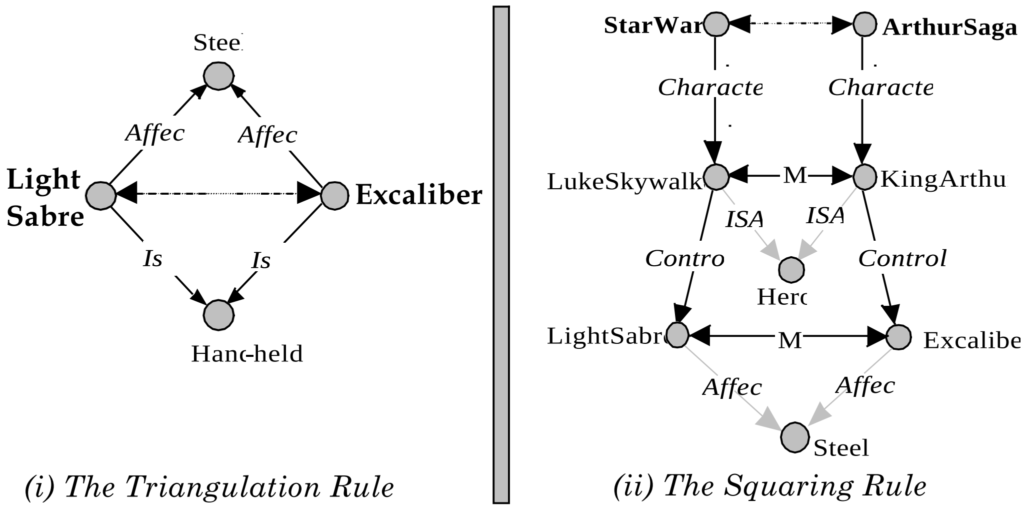
and **Chewbacca** is like **Cowardly-Lion**

and **Han-Solo** is like **Scarecrow**

and **Princess-Leia** is like **Wizard-of-Oz**

and **Death-Star** is like **Witch-Castle**

Figure 4: Interpretation of the cinematic analogy 'Star Wars is the Wizard of Oz'.



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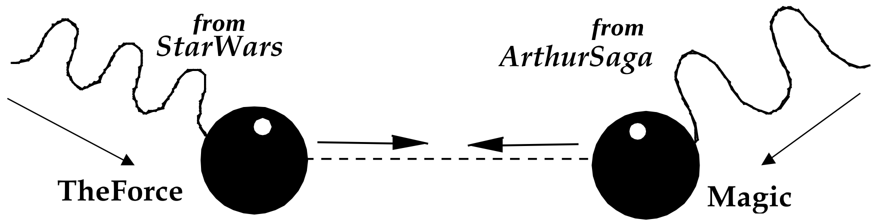

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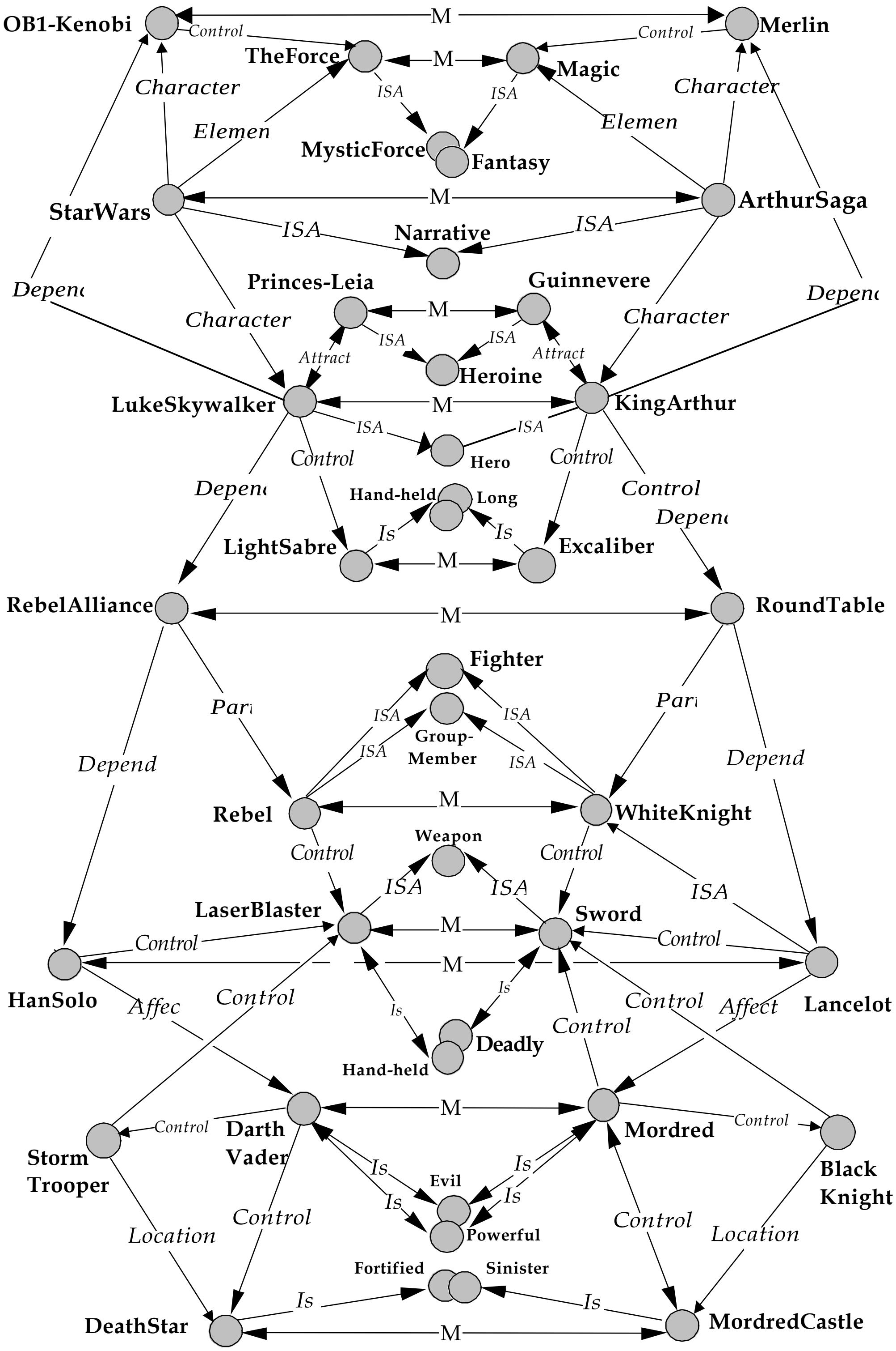


Figure 7: Partial Sapper descriptions of the semantic networks that comprise a mapping between StarWars and ArthurSaga, the conceptual representation of two narratives (Key: bi-directional arrows labeled "M" depict Sapper bridges).

If **King-Arthur-Saga** is like **Star-Wars**

Then **Dark-Ages** is like **A-Long-Time-Ago**

and **Camelot** is like **A-Galaxy-Far-Far-Away**

and **Magic** is like **The-Force**

and **King-Arthur** is like **Luke-Skywalker**

and **Guinnevere** is like **Princess-Leia**

and **Lancelot** is like **Han-Solo**

and **Merlin** is like **Obi-Wan-Kenobi**

and **Excaliber** is like **Fathers-Light-Saber**

and **Uther-Pendragon** is like **Lukes-Father**

and **Mordred** is like **Darth-Vader**

and **Mordreds-Castle** is like **Death-Star**

and **Knights-Of-Round-Table** is like **Rebel-Alliance**

and **Knight-Of-Round-Table** is like **Rebel**

and **Obtain-Arthur-Grail** is like **Buy-Luke-C3PO-R2D2**

and **Obtain-Arthur-Excalibur** is like
Obtain-Luke-Fathers-Light-Saber

and **Advise-Merlin-Arthur** is like **Advise-Obi-Wan-Luke**

and **Declare-War-Mordred-Camelot** is like
Declare-War-Empire-Rebels

and **Battle-Arthur-Mordred** is like **Attack-Luke-Darth-Vader**

and **Kill-Arthur-Mordred** is like **Defeat-Luke-Darth-Vader**

and **Marry-Arthur-Guinnevere** is like **Love-Luke-Princess-Leia**

Figure 8: Structural Basis for the metaphor "Star Wars" is the "Arthur Saga".

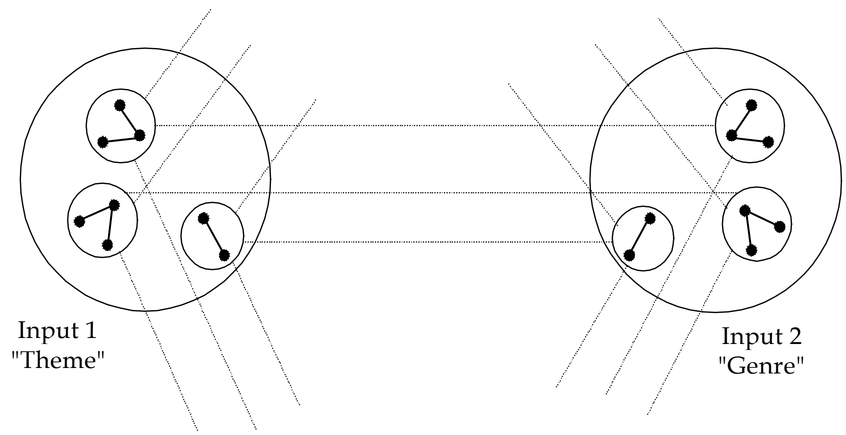
Cinematic Blend	Original Story Basis	New / Target Genre
The Natural (1984)	Arthur Saga (myth)	Baseball
Star Wars (1977)	Arthur Saga, Shane (1953) The Dam busters (1954) The Hidden Fortress (1958)	Science Fiction
Days of Thunder (1990)	Top Gun (1986)	Indycar Motor Racing
Wall Street (1987)	Platoon (1986)	High-Stakes Finance
Roxanne (1987)	Cyrano de Bergerac (1950)	Screwball comedy
Outland (1981)	High Noon (1952)	Science Fiction / Space
The Flintstones (TV)	The Honeymooners (TV)	Neolithic life
The Magnif. Seven (1960)	The Seven Samurai (1954)	Western “horse opera”
True Romance (1993)	Badlands (1973)	Tarantino Bravura
Robocop (1987)	High Plains Drifter (1972)	Science Fiction
West-Side Story (1961)	Romeo and Juliet (1594)	Jazz / Gang Warfare
Apocalypse Now (1979)	Heart of Darkness (1902)	Vietnam counterculture
Bladerunner (1981)	Do Androids Dream... (1969)	Film Noir Detective
Brazil (1983)	George Orwell’s “1984”	Monty Python Humour
Forrest Gump (1984)	Candide (Voltaire 1759)	American History
Jurassic Park (1993)	WestWorld (1973)	Genetics/ Dinosaurs
Forbidden Planet (1956)	The Tempest (1611)	Science Fiction
Water World (1995)	Mad Max II/III (1979,85)	Water Sports
Independence Day (1996)	H. G. Wells’ War of The Worlds	Star Wars Sci-Fi (1977), Henry V Classicism
Mars Attacks (1997)	Independence Day (1996)	Comedy/Gremlins (1984)
The Crucible (1996)	Salem Witch-hunts	McCarthy/HUAC hearings
The Ghost and the Darkness (1996)	Jaws (1977)	Big-Game Hunters, African Man-Eaters
Elizabeth (1998)	The Godfather (1977)	History / Costume Drama

Figure 9: Clear cases of narrative blending.

If **Star-Wars** is like **The-Dambusters**

Then **A-Galaxy-Far-Far-Away** is like **Europe**
and **The-Empire** is like **The-Third-Reich**
and **Darth-Vader** is like **Himmler**
and **Rebel-Base** is like **Blightey**
and **A-Long-Time-Ago** is like **The-Forties**
and **X-Wing-Fighter** is like **Lancaster-Bomber**
and **Space-Rebel** is like **Allied-Soldier**
and **Rebel-Alliance** is like **The-Allies**
and **Rebel-Command-Centre** is like **Allied-Command-Centre**
and **Death-Star** is like **Ruhr-Dam**
and **Death-Star-Waste-Vent** is like **Ruhr-Dam-Sweet-Spot**
and **Build-Empire-Death-Star** is like **Build-Germany-Ruhr-Dam**
and **Declare-War-Empire-Rebels** is like **Declare-War-Germany-Allies**
and **Advise-Command-Centre-Rebels** is like **Advise-Command-Centre-Allies**
and **Destroy-Rebel-Alliance-Death-Star** is like **Destroy-Allies-Ruhr-Dam**
and **Celebrate-Rebel-Alliance** is like **Celebrate-Allies**

Figure 10: Structural Basis for the Metaphor "Star Wars "is "The Dam Busters"



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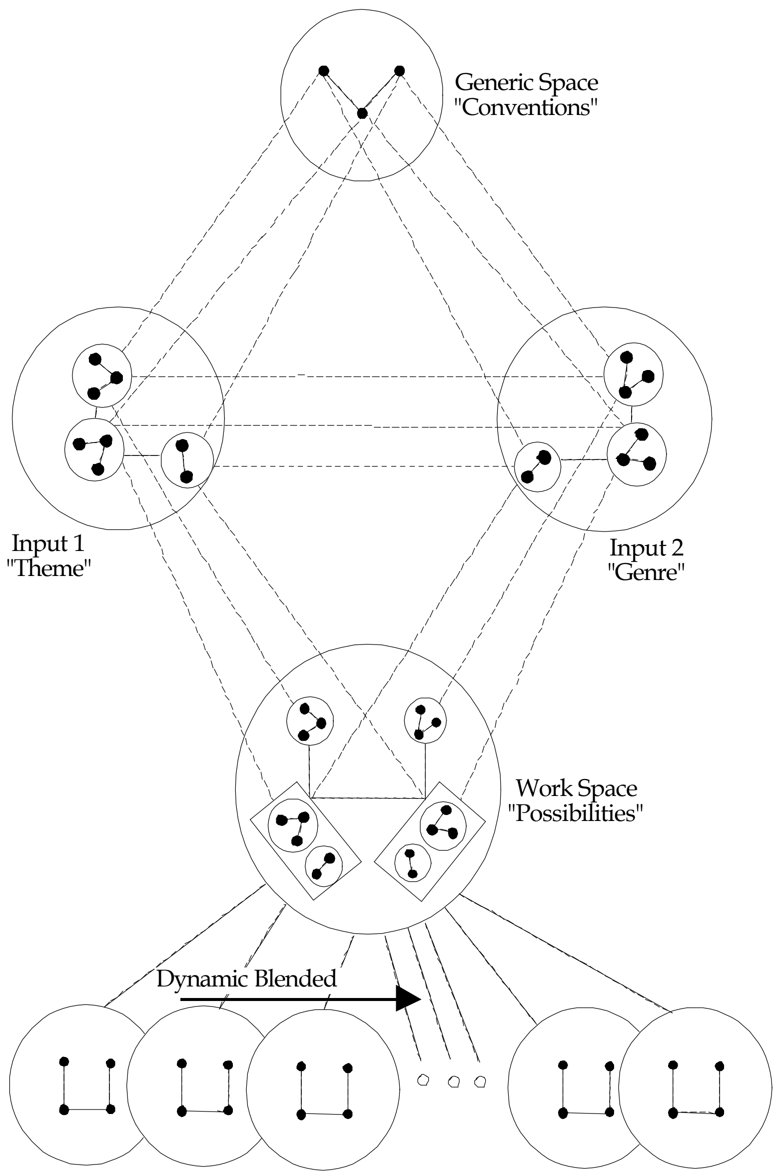

Figure 12: A revised blended space model which accounts for the dynamic nature of complex narrative blends

Author Wish-List		Source Domain
• Magic	—	Arthurian Saga, Lord of the Rings, etc.
• Sword-Play	—	Arthurian Saga, Robin Hood, etc.
• Good Versus Evil	—	Arthurian Saga, The Dam-Busters, etc.
• Adventure	—	Arthurian Saga, The Dam-Busters, etc.
• Aerial Combat	—	The Dam-Busters, Top Gun, etc.
• Ends with a Bang	—	The Dam-Busters, Dr. Strangelove, etc.
• Happy Ever After	—	The Dam-Busters, Robin Hood, etc.

Figure 13: Various Retrieval Cues for Unstructured Recall of Narratives.

If **King-Arthur-Saga** is like **The-Dambusters**

Then **Round-Table** is like **England**
and **Camelot** is like **Europe**
and **Middle-Ages** is like **The-Forties**
and **Mordred** is like **Himmler**
and **Mordreds-Castle** is like **Ruhr-Dam**
and **Knights-Of-Round-Table** is like **The-Allies**
and **Knight-Of-Round-Table** is like **Allied-Soldier**
and **Declare-War-Mordred-Camelot** is like **Declare-War-Germany-Allies**
and **Advise-Merlin-Arthur** is like **Advise-Command-Centre-Allies**

Figure 14: A Tentative Blending of the Arthur and Dambusters Analogs

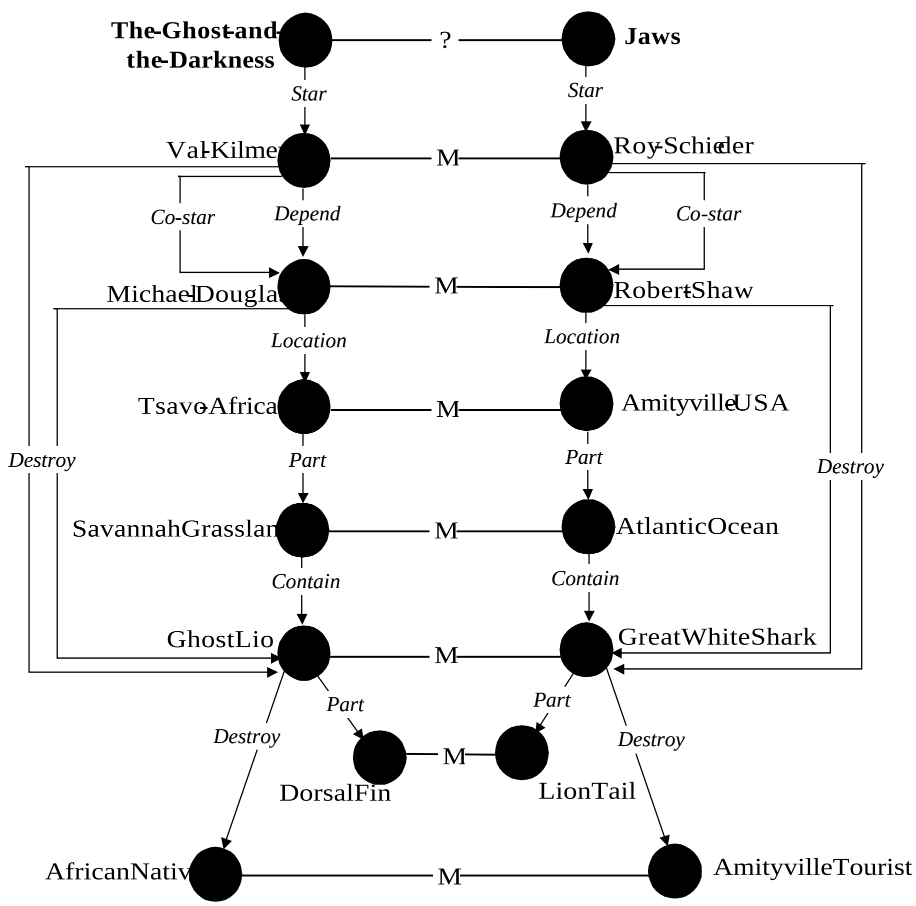

Figure 15: Scout — the retrieval component of Sapper— searches for a potential vehicle for the tenor concept TheGhostAndTheDarkness (a conceptual representation of the film of the same name). This figure illustrates that Scout has found seven different bridge-based pathways from the node TheGhostAndTheDarkness to the node Jaws, establishing a strong case for considering both as analogous.

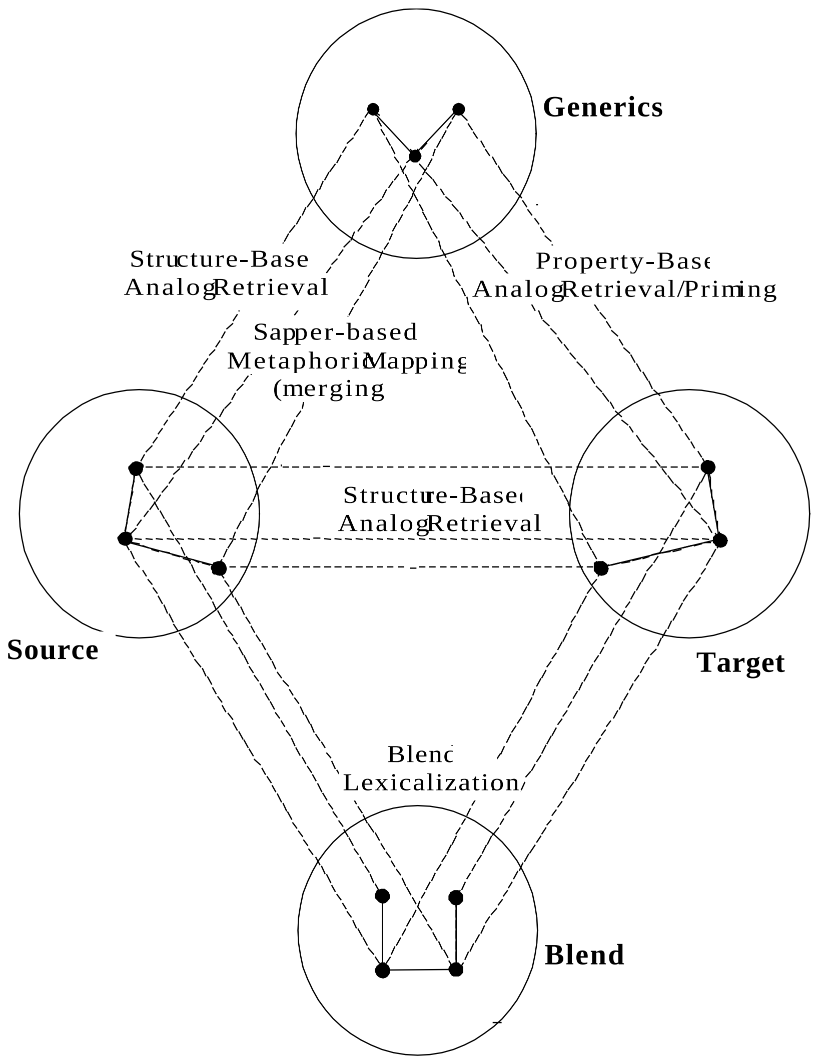

Figure 16: Sapper and Scout provide the computational workings of Pastiche, a model of conceptual blending, by mediating the interaction between different spaces.