Integrated cognitive semantics applied to Halkomelem

Brent Galloway
Saskatchewan Indian Federated College/University of Regina

Abstract. This paper offers a newly integrated account of cognitive semantics and shows how it can be used to provide many insights on the cognitive processes of Upriver Halkomelem and of language in general. The theories of cognitive semantics which it integrates and applies to Halkomelem are: spreading activation (Ashcraft 1989), connectionism (Gasser 1990), three-dimensional semantics (Galloway 1993a, 1993b , 2000), vantage theory (MacLaury 1995), cognitive frames (Barsalou 1992), cognitive image schema (Lakoff 1987), semantic roles (Galloway 1999), and epistemic and ontological correspondences of metaphors (Lakoff 1987). Each theory is outlined or discussed briefly, then a combined approach is discussed and applied to Upriver Halkomelem (Halq'eméylem). Cognitive frames are drawn for a Halq'eméylem metaphor, SPIRIT-DANCING IS REINCARNATION/REBIRTH, suggesting that cognitive frames of metaphors show very similar patterns of activation and may use many of the same three-dimensional neural pathways and patterns of activation.

1 Connectionism, spreading activation in the brain, and 3-D Semantics.

We know that the brain works using a process of spreading activation (Ashcraft 1989). This involves the extra infusion of blood and excitatory and inhibitory chemicals to parts of the neural network that are starting to be used. This has been demonstrated and utilized in numerous and increasing experiments with PET scans and MRI scans of the brain in attempts to map which areas of the brain do cognitive processing of which types of semantic information (for example, Posner, Petersen, Fox, and Raichle 1988, Tulving and Schacter 1990). The theory of connectionism is a realistic attempt to show how this can be applied to language learning, language processing, and long-term and short-term memory. Here is a summary of the major points of connectionism from Gasser 1990 (pp.181-2):

> "Most connectionist models share the following basic features:
>
> 1. The system's memory consists of a network of simple processing units joined by weighted connections. Each weight is a quantity determining the degree to which the unit at the source end of the connection activates or inhibits the unit at the destination end of the connection.
> 2. The behavior of units is based loosely on that of neurons. They sum the inputs they receive on connections and compute an activation, which is a function of the total input, and an output, which is a function of the activation. A unit's output is passed along its output connections to other units. The current pattern of activation on the units in the system corresponds to short-term memory in more traditional models, and inputs and outputs to the system take the form of patterns of activation over groups of input and output units.
> 3. The analogue of long-term memory in other models is the set of weights on the network connections. In learning models, these weights are adjusted as a consequence of processing.
> 4. Processing is parallel. In most traditional models, as in conventional computers, decisions and actions are made one at a time. In connectionist models, as in the brain, there is activity in many

places simultaneously.

5. Control is distributed. Unlike traditional cognitive models, connectionist systems have no central executive whose job it is to determine which rule or rules are currently applicable and to execute them. In fact, there are no rules to be executed.

"Connectionist models divide into two basic categories: ***localist*** approaches (e.g., Cottrell, 1989; Feldman & Ballard, 1982; Gasser, 1988; Waltz & Pollack, 1985), in which units represent particular concepts, such as BLUE2, GLASNOST, ELVIS-PRESLEY, INANIMATE, and TRANSITIVE-CLAUSE; and ***distributed*** approaches (e.g., McClelland, Rumelhart, & PDP Research Group, 1986; Kanerva, 1989; and Rumelhart et al., 1986), in which complex concepts are distributed over many units, and each unit participates in the representation of many concepts. ...It is the distributed models which have attracted the most attention, are better suited for learning, and have the. most radical claims to make,...The interesting properties of (distributed) connectionist networks include the following:

1. Robustness, graceful degradation: The systems do not break down when inputs are incomplete or errorful, or even when a portion of the network is destroyed.
2. Graded representations: The concepts that the systems acquire and make use of bear little resemblance to the discrete categories of traditional models. Things belong to connectionist ***categories*** to varying degrees, the representations continually evolve as the system learns, and concepts are free to blend in intricate ways,
3. Fixed memory size: Because knowledge is shared in the system's connections, the addition of new knowledge does not necessarily require new units and connections.
4. Automatic generalization, rule-like behavior: As connectionist systems learn about specific patterns, they are also building the knowledge that will allow them to handle a range of similar patterns. That is, they are making generalizations, possibly at many different levels of abstraction. Unlike the rules of traditional models, however, these generalizations do not appear explicitly in the network. Rather they arise as needed during processing.
5. Interaction of multiple sources of knowledge: Connectionist systems work by integrating information in the form of the parallel spread of activation in many parts of the network at once. This approach lends itself to modelling in domains where decisions are made on the basis of diverse sorts of knowledge."

This combines in a natural way with my theory of Three-Dimensional Semantics (Galloway 1971, 1993a, 1993b). The next section offers a point form summary of 3-D Semantics from Galloway 1993b).

2 Three-dimensional semantics in outline.

"Three-Dimensional Semantics builds on some of the parallels between phonology and semantics but finds interesting differences too.

2.1 Three levels are set up within semantics or semology:

SEMETIC (or SEMANTIC) for narrow transcriptions, semantic components, and ['allosemes'] (allosemes of a single sememe are meanings in complementary distribution or free variation in the semetic environment and are semetically similar);

SEMEMIC for broad transcriptions, /'sememes'/ (the broad glosses from which the allosemes are predictable, given enough of the semetic environment; a sememe can be the gloss of a morpheme, a derived word, or a phrasal idiom);

MORPHOSEMEMIC for //'morphosememes'// representing changes, alternations, or variations of sememes in predictable sememic or morphological environments.

2.2 The theory proposes that semantic domains, like our brains, are three- dimensional, rather

than two-dimensional, and can be better visualized as 3-D mobiles, with subdomains and allosemes each hanging by a componential thread (the domain/subdomain name); these semantic connections create three-dimensional semantic networks between domains and words that may help facilitate the progression of thought and the matching of allosemes with the semetic environments that condition them.

2.3 Domains and (sub)subdomains can have any number of branches. Anything that can be glossed (from sound symbolism through syntactic structures and semantic roles) should fit within a semantic domain. When a number of semantic domains have been elicited, it is wise to undertake an inventory of the semantic domains in the language; one can start with all those needed to account for all the words obtained and keep revising it as more words are gathered.

2.4 An alloseme can have membership simultaneously in different domains or subdomains.

2.5 A sememe can have allosemes in more than one (sub)domain.

2.6 The semetic environment for each alloseme is provided to a major extent in sentences by the alloseme's superordinate (sub)domains but can also be provided by other semetic or pragmatic information that allows the superordinate (sub)domain or required environment to be inferred. Where allosemes are so similar that they occur next to each other as coordinate members of the same subdomain, then more detailed semetic information present in the glosses must be found in the environment before the alloseme can be predicted from the semetic environment. The semantic role of each word or phrase in the sentence may also be a relevant part of the semetic environment.

2.7 The semetic environment also includes any relevant pragmatic information, such as the meanings of facial expressions, body language, proxemics, sensory information, or shared experiential or cultural information. The relevant meaning of such information can be transcribed in the same language as the glosses of the words and used as semetic environment in the same way. Only relevant information need be so transcribed in order to predict allosemes.

2.8 A ***principle of most likely interpretation*** is sufficient for most alloseme prediction or interpretation--that is, we jump to the most likely alloseme based on the semetic context, or, faced with insufficient diagnostic context, to the most frequent alloseme (and thus most likely in absence of sufficient context), and we operate with that until we get further information.

2.9 Ambiguous or semetically incomplete sentences are frequent and often intentional; we may interpret them by the most likely interpretation principle, leave them unresolved for a time, or ask questions to elicit more of the semetic environment.

2.10 Domain membership and organization may change as a speaker learns new words and new domains may even be added and developed.

2.11 Some domain or subdomain names are sometimes unlabeled in a given language but their semantic content can be factored out through shared components of all their members.

2.12 Prototypical visual images, smells, etc. are semetic elements stored perhaps in similar ways to other semetic information; images of color ranges could be filed under the subdomain of LIGHT in English, for example.

2.13 Conjunctions, semantic roles, and logical operators may be similarly stored in their own semantic domain. But once the allosemes are all determined, these units are all used in linking meanings into phrasal, co-referential, and modifying semantic groups and in larger content units of sentences, speech acts, and communicative events.

2.14 ***Pattern congruity*** (parallelism in patterns) can be demonstrated on all three semantic levels and makes semantic rules all the more useful and persuasive.

Metaphors are only one type of pattern congruity but are perhaps the most influential.

2.15 Derivation of words is done by cycling from the sememic level to the morphosememic level and back again: two sememes adjust to each other and may become something different than the sum of the parts, this produces a morphosememe or new meaning, and this new meaning itself becomes a sememe with allosemes.

2.16 A sememe can have one or many allosemes; allosemes can be predictable or can be in free variation with one another. They can also have overlapping semantic ranges, inclusive semantic ranges, continuous semantic ranges, or discontinuous semantic ranges. Continuous ranges can be shown on domain diagrams by a single gloss with its most distant continuous allosemes separated by commas on a single branch. Inclusive and overlapping semantic ranges need to be shown on domain diagrams by separate entries.

2.17 Semantic co-occurrence restriction patterns can be treated in the morphosememics chapter (this is analogous to phonotactics and phonological canon within morphophonemics) since they involve co-occurrence of sememes with each other.

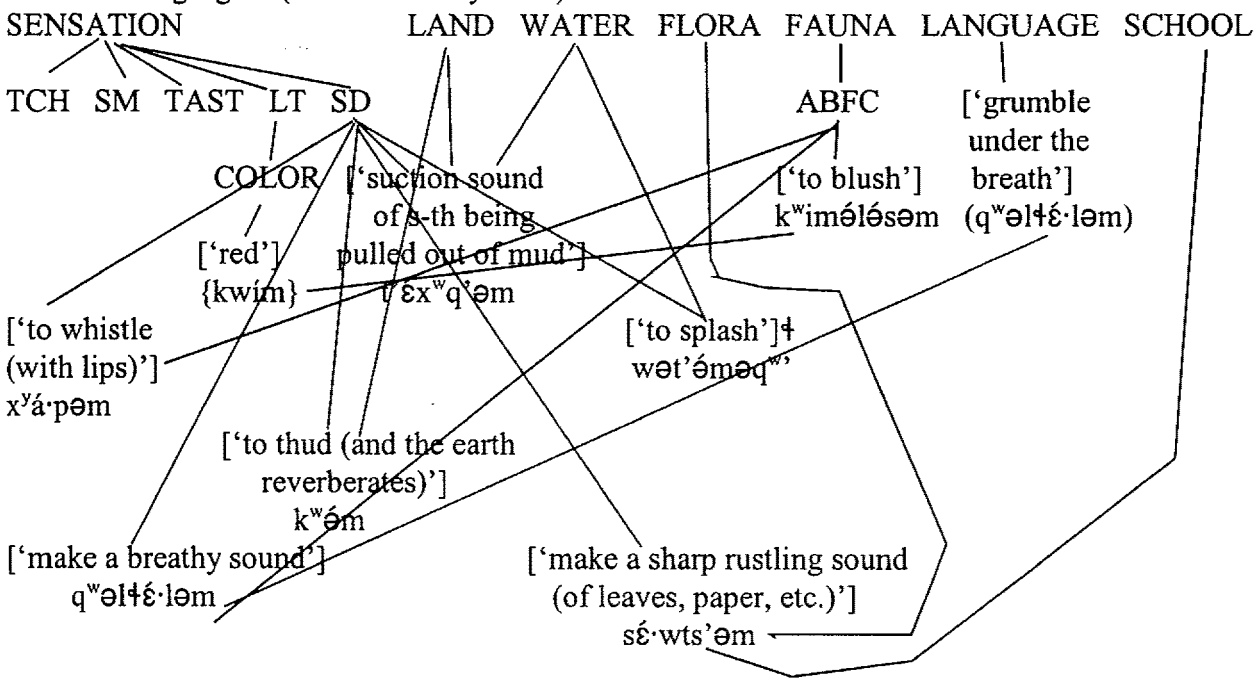
2.18 Fuller integration of the work of anthropologists by using ethnographies to provide trial lists of culturally significant semantic domains to elicit by and confirm or modify with linguistic data, and to provide possible semetic and sememic input to the glosses.

2.19 Notation of levels is shown above (['semetic'], /'sememic'/, //'morphosememic'//) and (sub)domains can be indicated in all-caps.

2.20 Semantic domains may indirectly reflect actual networks of neurochemical connections in the brain, growing and changing as the latter change; 3-D domains are certainly analogous in many ways to such neural networks.

2.21 3-D semantic domains, being connected by semantic componential strings (like neural networks), may well be instantly reorganizable or creatable to take advantage of almost constant additions to our knowledge and to reflect or be reflected in new neurochemical pathways; thus domains could be more dynamic or fluid in nature than we had thought."

The following figure (from Galloway 1989) illustrates some of these features.



Connectionism combines naturally with 3-D Semantics which sets up 3- dimensional semantic domains whose domains and subdomains are semantic components and whose members (allosemes) can have multiple connections with: the phonological pattern of activation of the Halkomelem word, the morphological and syntactic patterns of activation of the word, and the patterns of activation of: all the nearest members of the subdomain of the alloseme of the word, other subdomains relevant to the alloseme, other allosemes of the same word, and connections with episodic memory portions of the brain which involve the use of this and the other allosemes of the word (including sensory patterns of activation so triggered). This simultaneous activation allows one to view information from different vantages and this is where MacLaury's interesting vantage theory comes in (MacLaury 1986ff). Combined with connectism it means that the highest sum of the active connections at a given moment are the dominant vantage and the other patterns of activation or those not currently activated are the recessive vantages.

Since each alloseme seems to be more strongly activated in one of its possible multidomain connections, I have discovered that my Upriver Halkomelem dictionary is already set up as a connectionist dictionary. The following excerpt shows this.

2. An Entry from the Connectionist, 3-D Semantics Dictionary of Upriver Halkomelem.

<á:wkw'>, free root, //ʔé·wk'ʷ//, HHG /'***belongings***'/ (AC), CLO /'***clothes***'/, nominal, for ex. <I swá á:wkw'> /I swé ʔé·wk'ʷ/ /'***That belongs to me.***'/, lit. "It's my own belonging." AC; <iyóqthetchxw ta' á:wkw'> /ʔiyáq=θət-c-xʷ t-ɛʔ ʔé·wk'ʷ/ /'***Change your clothes*** '/ EB; <lemlémetchxw mékw' yel á:wkw'> /lə́m=əT-c-xʷ mə́k'ʷ yə-l ʔé·wk'ʷ/ /'***Fold all my clothes***'/

<shxw'awkw'ála>, derived nominal, //sxʷ=ʔɛwk'ʷ=élɛ//, HHG /'***clothes basket***'/, CLO, BSK, with shxw= /'nominalizer, something for'/, =la /'container of'/', nom.

<awkw'áwtxw>, derived nominal, //ʔɛwk'ʷ=ɛ́wtxʷ//, BLDG /'***clothes store***'/, CLO, with =áwtxw /'building for'/, nom., cf ith'emáwtxw /'***clothes store***'/

<á:wkw'mal>, derived nominal, //ʔé·wk'ʷ=mɛl//, TOOL /'***tool case***'/, with =mal /'part, portion'/, nom., attested by EB

<áwkw'emálá>, derived nominal, //ʔɛ́wk'ʷ=əm=élɛ́//, HHG /'***suitcase***'/ (Deming), /'***luggage***'/ (Deming), /'***clothing container, clothes bag, trunk (for clothes)***'/, etc., CLO, with =em /'place to have/get'/, =álá /'container of'/, nom., alternate form: <shxw'áwkw'emálá> //sxʷ=ʔɛ́wk'ʷ=əm=élɛ́//, 1HHG /'***suitcase***'/, alternate form: <shxw'á:wkw'emálá ~ shxw'á:wkw'álá> //sxʷ=ʔé·wk'ʷ=əm=élɛ́ ~ sxʷ=ʔé·wk'ʷ=élɛ́//, HHG /'***clothes container, suitcase, clothes case***'/, CLO, attested bu EB

Notice that in the main entry the first word has two allosemes, one in the domain of HOUSEHOLD GOODS and one in the domain of CLOTHING. When other words in the sentence belong to a matching domain it makes that meaning most likely. In the first derived form from the root, the meaning belongs more in HOUSEHOLD GOODS and has the connection there with the highest weight in connectionist terms; but it also has connections with lower weights in the domains of CLOTHING and BASKETRY. In the second derived form, the meaning or sememe has the highest weighted connection in the domain of BUILDINGS, but it also has lower-weighted connections with CLOTHING. The next derivation belongs in the domain of TOOLS and has a high weighted connection there. The last derived form has a number of allosemes, all more highly weighted in HOUSEHOLD GOODS but all with lesser weighted connections in CLOTHING as well.

3. Semantic Information in a Descriptive Grammar of Upriver Halkomelem: pattern congruity in allosemes, metaphors, and derivation, and the domain subdomain hierarchies. Such a dictionary as in the previous sections is a model of many of the patterns of activation used by speakers of Upriver Halkomelem. But a descriptive grammar of the language is also a model of many additional patterns of activation involved in speaking and using the language, especially those that we call morphological patterns and syntactic patterns. As I have discussed at this conference before, a grammar should also have one or more substantial chapters on the semantic patterns in the language, including description of significant pattern congruity in allosemes, metaphors, and derivation, and the domain subdomain hierarchies found in the language. These are also weighted patterns of activation that are most important for the proper semantic use of the language. Here are four short excerpts from chapters 12 and 13 in Galloway 1993a which do this for Upriver Halkomelem.

***pattern congruity in allosemes*:**

"Words for ancestors more than two generations above ego each have an alloseme three or more generations above ego and an alloseme the same number of generations below ego; thus for each alloseme such as 'great grandparent: there is one such as 'great grandchild' as a gloss for the same word. Since one alloseme is six, eight, ten, or twelve generations above the other in each case, it is usually quite clear from the semantic context which alloseme is meant; such semantic factors as relative age, tense, actions which could be done only by a mature person or ancestor or by a child or descendant, matching reference to a person whose age is known to the hearer, etc. are diagnostic." (p.502)

in metaphors

WEATHER IS ACTIONS OF THUNDERBIRD

/χə́ləq'ṯ tə sxʷəxʷá·s/ 'to lightning' (literally "Thunderbird opens his eyes."), /qwíyχtəs tə ɬə́ptəls tə sxʷəxʷá·s/ 'Lightning happens.' (lit. "Thunderbird moves or shakes his eyelashes."), /qwíyχtəs tə ƛ'qɛ́·ls tə sxʷəxʷá·s/ 'There's thunder.' (lit. "Thunderbird shakes/moves his wings."), /mə sə́χʷə tə sxʷəxʷá·s/ 'It starts to rain.' (lit. "Thunderbird is starting to urinate."p.626

in derivation

"20 flora are named for their appearance (p'əl-p'ɛ́lqəm-ɛ́·ləws /'cottonwood; poplar'/ < //'many-flashing-leaf'//), 9 for uses as medicines (θ'q'ʷíwíy-əɬp /'swamp gooseberry'/ < //'hemorrhoid plant'//); 6 for use in man-made objects, five for what they do, five for how harvested, three for taste, three for fauna that use them, two for how eaten, two for where grows, one for kinship to another plant;....About 70 of 218 names for fauna are named for their roles or habits (including sounds) or for their appearance or for their origin (spəlwɛ́ɬ qʷɛ́·l /crane fly, leatherjacket'/ < //'last year's mosquito'//).(p.650)

the domain subdomain hierarchies

"FAUNA: subdomains incl. classes (HUMAN, QUADRUPED/ANIMAL, FISH, SUPERNATURAL CREATURES (/sƛ'ɛ́ləqəm/), LARGE BIRD, SMALL BIRD, WORM/BUG, SNAKE, FROG, LIZARD, SPIDER, BEE, MOSQUITO, FLY, ANATOMY, BODY INSULTS or /pə́sqwtəl/, BODY FUNCTIONS, BODY DYSFUNCTIONS (SYMPTOM/ILLNESS/DISABILITY, ACCIDENT/INJURY, MEDICINE/NON-SHAMAN CURING, LIFE-HEALTH /DEATH-SICKNESS)" (p.488)

4 Metaphors and their cognitive bases: ontological and epistemic correspondences for SPIRIT-DANCING IS REBIRTH/REINCARNATION.

Metaphors are not only patterns of allosemes in which sets of words have allosemes in the same two domains or subdomains but they are also related by ontological and epistemic correspondences, as pointed out by Lakoff (1987) and others. The target domain is the semantic domain which one is trying to express the metaphorical meaning (here SPIRIT-DANCING); the source domain is the domain from which words are borrowed (have stronger weights in)(here REBIRTH/REINCARNATION) and given the new metaphorical allosemes. Ontological correspondences show the individual elements in the source domain that correspond with individual elements in the target domain. Epistemic correspondences show the parallels in how each alloseme functions cognitively in the source and target domains. These correspondences show the pragmatic understanding of how things work and how they are parallel in two different domains or subdomains. From the point of view of connectionism and 3-D Semantics, they show and probably use similar patterns of network activation. The metaphor SPIRIT-DANCING IS REBIRTH/REINCARNATION shows such patterns.

Its ***epistemic correspondences*** include:

a) Target Domain: The new candidate is often someone who is killing himself and injuring those around him by his behaviour (drugs, violence, drink, abuse, etc.) and is near death.
Source Domain: The new patient is often someone who is killing himself and injuring those around him by his behaviour (drugs, violence, drink, abuse, etc.) and is near death.

b) Target Domain: The family gives permission for the longhouse committee to kidnap and if necessary club unconscious the new candidate without his knowledge or permission and to end his old (way of) life.
Source Domain: The family gives permission for the final doctors to turn off life support and end his life and to look for signs of death in the patient without his knowledge or permission.

c) Target Domain: When a person is "grabbed" or "taken" to be a spirit dancer, his/her family has often given up on the person ever curing themselves of damaging behaviour and has given permission for the long house committee to take him (his body) to the longhouse.
Source Domain: When a person is taken by death, his/her family has often given up on the person ever recovering and has given permission to the doctors to take the body away.

d) Target Domain: When a person is taken by the doctor, the doctor performs final checks to make sure that the person is really unconscious and dead.
Source Domain: When a person is taken by the longhouse committee, they often club the person to render him unconscious if he resists.

e) Target Domain: When a new initiate first comes to, he/she is in the darkened longhouse and does not understand all that is going on.
Source Domain: When a pre-born baby first comes to, he/she is in the womb and does not understand all that is going on.

f) Target Domain: The new initiate is called /sqɛ́qələ/ 'a spirit-dancing initiate' (lit. "baby"),
Source Domain: A pre-born and newborn is called /sqɛ́qələ/ 'baby'.

g) Target Domain: A new initiate must get all his/her sustenance only through a straw and cannot eat.
Source Domain: A pre-born baby must get all his/her sustenance only through an umbilical cord and cannot eat.

h) Target Domain: A new initiate is occasionally surprised, at random intervals, by sudden loud

noises from often unidentified sources.
Source Domain: A new baby is occasionally surprised, at random intervals, by sudden loud noises from often unidentified sources.
i) Target Domain: One looking after the new initiate is called /tə xʸaɬəmíyɬ/ 'the guardian of a spirit-dancer being initiated, "baby-sitter"' (lit. "the one who looks after a child/baby-sits")
Source Domain: One looking after the new baby is called /tə xʸaɬəmíyɬ/ 'the one who looks after a child/baby-sits'
j) Target Domain: A new initiate usually suffers some pain in the initiation process.
Source Domain: A new born baby usually suffers some pain in the birth process.
k) Target Domain: A new initiate is gradually taken out of the longhouse to walk and swim daily so he gets stronger and is able to walk and swim.
Source Domain: A new baby is gradually taken out of the crib to learn to crawl and bathed daily.
l) Target Domain: A new initiate after a week or two is taken out to the woods and abandoned to seek his guardian spirit and learn to dance and sing from a vision of the guardian spirit.
Source Domain: A new baby after a year or so is gradually taken out to learn to walk and talk from his parents
m) Target Domain: When the spirit dancer has returned from a successful vision quest of a day or two his dance and song are observed and "straighten out" by older dancers and singers, who also gather other dancers and singers around to learn to play and sing the new song.
Source Domain: When the baby has seen enough adults walking and talking, his walking and talking are observed and "straightened out" by older people who walk and talk, who also gather other family members (walkers and talkers) around to learn to walk and talk with the new baby and his way of walking and talking.
n) Target Domain: The new spirit song is often the same as the spirit song of a spirit dancer who died some years before and thus is a reincarnated in the new dancer.
Source Domain: The way a child talks and behaves may reflect the talk of a person dead some years before and thus reincarnated in the new child.
o) Target Domain: After the new dancer has done this he is still weak and must sometimes be kept on a tether or leash.
Source Domain: After the new baby has done this he is still weak and must sometimes be kept on a tether or leash.
p) Target Domain: Those that watch over and sustain a new dancer are called his "family".
Source Domain: Those that watch over and sustain a new baby are called his "family".
q) Target Domain: A new dancer is still called /χɛws-á'lkʷɬ/ ("new spirit-dancer") until his first four years have passed.
Source Domain: A baby is still called a baby until his first four years have passed.
r) Target Domain: After the first few years a new dancer gradually becomes aware (/mə p'əɬ/) of his new life.
Source Domain: After the first few years a new baby gradually becomes aware (/mə p'əɬ/) of his new life.

The same metaphor's ***ontological correspondences*** include:
The candidate near death is the patient near death.
The physically and spiritually deadly behaviour is the fatal illness.
Giving up on the candidate is giving up on the patient\

The longhouse committee's grabbers are the final doctors.
Grabbing and clubbing the initiate unconscious are turning of the life support systems.
The family giving permission to end the old (way of) life is the family giving permission to turn off the life support systems.
The darkened longhouse is the womb.
The drinking straw is the umbilical cord.
The attendants are the babysitters.
The new initiate is a baby.
The physical pain and confusion of initiation is the pain and confusion of childbirth for the child.
Learning to walk and swim is learning to crawl and bathe.
A week or two of initiation is a year or so of babyhood.
The initiate's caretakers and support personnel are the baby's family.
Going on a spirit quest is the first steps in walking.
The guardian spirit is the child's teacher/parent
Learning his dance is learning to walk.
Learning to sing his spirit song is learning to talk.
The one straightening out the song and dance is the one correcting the child in learning to walk and talk.
The singers and drummers who learn the song and dance are the family and acquaintances who learn to interpret the child's walking and talking.
The reincarnated spirit song and spirit dance of a previous spirit dancer are the reincarnated behaviour of someone previously deceased.
The weakness of a new dancer is the weakness of a baby or young child.
Those that watch over and sustain a new dancer are called his "family".
The first four years of a new dancer are the first four years of a baby.

5. Semantic Roles and Logical Operators in Upriver Halkomelem

Semantic roles specify the semantic functions of words in phrases and words and phrases in sentences. Since they link the semantic content of words together and give the meanings of syntactic constructions and many grammatical morphemes, they are related closely to logical operators like 'and', 'if', 'or', 'then', etc. My approach in 3-D semantics and an approach of connectionism is to link these together into a single semantic domain which has subdomains and whose members also have simultaneous connections with a number of other domains or subdomains. As blood and neurochemicals move to parts of the neural network and activate these connections, one can see that the domain members of this domain are often activated by spreading activation. This makes it easier to choose among them as required in sentences and phrases and use the grammatical affixes quickly and efficiently. A section of Galloway 1993a discusses these interrelations and networks.

"Semantic Roles. Work of Fillmore, Chafe, Dillon, and others have produced inventories of universal semantic roles. Most of these, and some new ones, are also present in Halkomelem. My research suggests the following members, including many members and perhaps some complete (sub)domains from those discussed in 13.2.20 through 13.2.27: agent, patient (dynamic, static, process, transfer, or verbal), experiencer, recipient (proprietary or verbal), comitative, delegative, instrument, benefactive, malefactive, time (duration, point, start, finish), manner, place (dynamic range, static range, source, destination), material, referent (limits of a state or process), result (state of patient after a process), telic (purpose), vehicle, force, or verb (dynamic, process, transfer, verbal,

psychological state, non-psychological state)), MOODS (interrogative, subjunctive, imperative, declarative), ASPECTS (continuative, noncontinuative, resultative, durative, stative, inceptive, dispositional), CONTROL (purposeful, causative, accidental, manage to, psychological limited control, intransitive control), VOICE (active, middle, reflexive, reciprocal, passive), PERSONAL PRONOUNS (all express coreference and semantic roles above, such as agent through malefactive; independent pronouns also express focus and emphasis; subject and object pronouns express semantic roles within their own clauses, and also roles and relationships of entire clauses within the sentence; possessive pronouns express roles of possession as well as of cross-reference; object pronouns in the passive express patient or experiencer roles, besides coreference).

Some aspects listed express semantic roles already listed, such as result, time duration, time start, time finish; however, aspect sememes cannot give exact information on the duration, start, or finish of an action. Such information is given in subordinate clauses or clauses added in apposition.

Some control transitivizers also express roles already listed, such as telic/purpose, psychological state; however, control sememes cannot give exact information on the purpose or psychological state of an action. Fuller information is given in subordinate clauses or clauses added in apposition.

Some personal pronouns express roles already listed, such as agent, patient, recipient. However, the latter roles are also expressed by syntactic position and coreference with transitivizers. Thus members of the subdomain of agent include the agent allosemes of the pronoun sets 4.3, 4.4, 4.8, and 4.9 (numbers in Galloway 1993a) as well as the syntactic position of first of two NP's after a transitive verb. Any nominal or NP that fills the role of agent must be one of the pronouns mentioned or must occur in the position mentioned.

Similarly, the experiencer subdomain includes the same members but requires in addition the presence of a verb from the domain of emotions, feelings, attitudes, or mental processes or a verb with psychological non-control transitivizer.

The patient subdomain includes patient allosemes of pronoun sets 4.5, 4.8, 4.9, and 4.10, and the syntactic position of second of two NP's after a transitive verb or the first NP after a transitive verb with first or second person subject. The preceding verb must also be semantically able to take a third person patient.

The recipient subdomain includes recipient allosemes of pronoun sets 4.5, 4.8, 4.9, 4.10, and 4.11, and the syntactic position of second of two NP's after a ditransitive verb (one which can take two objects, such as ʔáxwəstəxʷ 'give it to s-o' or méstəxʷ 'bring it to s-o') or the first NP after a ditransitive verb with first or second person subject or direct object. The preceding verb must also be semantically able to take a third person recipient. Benefactive and malefactive roles are expressed by a verbal suffix, {-əɬc}, plus pronoun sets 4.5 or 4.10 or an object NP (the syntactic position of first of two NP's after a verb or the first NP after a transitive verb with first or second person subject).

Another way in which semantic roles are expressed is seen in subdomains such as, within the domain of travel and motion, goal of travel or manner of travel. Here the semantic roles of goal and manner are either fully or in part expressed within the verb of the subdomains. The roles of goal and manner, like many other roles, can also be further specified in subordinate clauses/phrases or clauses/phrases in apposition." (pp.607-609)

Definitions and examples of semantic roles in English:

Semantic roles of verbs:

Action (ACT): to actively do a single activity
push, lift, pass, sing, talk

Process (PROC): to do a named sequence of actions
organize, elect, marry, study, learn, build

State (STATE): to exist in some way or experience in some way
subtypes include:

Existential state: to exist in some way
be, live, remain, wait

Psychological state: to experience a psychological reaction
think, be angry, be happy, be confused, hear, see, smell, taste, go crazy

Motion (MOT): to move in some way (a type of action or process)
go, run, ride, travel, push, drop, climb, twitch, shake

Transfer (TRSF): to change the physical or abstract ownership of something
inherit, bestow, buy, sell, give, pass

Verbal (VBL): to use language or produce vocal communication of some kind
speak, sing, read, write, etc.

Semantic roles of other words or phrases:

Agent (AGT): the sentient being that carries out an action or process
Bill left., The big dog caught a mouse., She dropped her gown., The business was left in a shambles by the owner.

Benefactive (BEN): the one on whom an action has a secondary, good effect
They awarded the prize to Mary., They cleaned up the house for me.

Comitative (COM): accompanier of the Agent, Patient, etc.
Brent ran with his dog along the beach., She arrived with her hat in her hand., Desmond accompanied Mavis to the opera., Desmond went with Mavis.

Delegative (DEL): the person on whose behalf someone assumes the Agent role
Desiree accepted the prize on Julie's behalf., He'll report for me if I can't attend., They asked him to fill in for me.

Experiencer (EXP): the sentient being whose psychological state is described
The dog was very happy to jump in the car., Melvin feared for his life., The professor saw many of her friends at the nude beach., He was thinking for hours about her.

Force (FORCE): non-sentient entity that triggers an action or process
A very strong wind blew down the tent., A panic on the stock exchange destroyed all his profits.

Instrument (INSTR): the thing used by the Agent to carry out the action or process
We stirred the rich creamy broth with soup spoons for hours.

Malefactive (MAL): someone on whom an action has an adverse secondary effect
She ate the desert I had ordered., Bob told me a lie.

Manner (MANR): the way in which an entity performs as Agent or Force

Fido hungrily gnawed the bone., He spoke in an awkward way.
Material (MATRL): the state of the Patient before a process
He made a car out of soap., She changed him from a slob into a gent.
Patient (PAT): the most affected entity, in general
subtypes:
Dynamic patient (DYN PAT): the entity that is moving
Boris was sent home for spitting., He fired three shots.
Static patient (ST PAT): the entity that exists in a particular place or time
The ancient prehistoric camp was at the mouth of the river., The time is now., He lived in Philadelphia.
Process patient (PROC PAT): the entity changed by the action or process
They encouraged her to play the concerto., He flunked the test.
Transfer patient (TRSF PAT): the entity of which ownership or control is transferred
He gave me his watch., He stole a kiss., He gave me an idea.
Verbal patient (VBL PAT): what is said
Place or Location (LOC): physical or abstract location, e.g. on a scale
subtypes:
Dynamic Range (DR LOC): path or area traversed by PAT, AGT, etc.
We ran along the river., The music echoed through my mind.,
We rolled little Billy all the way down the hill.
Static Range (SR LOC): location of AGT, PAT, etc.
They were in the grocery store., He found the boys in a flour bin.
Source (SRC LOC): location of PAT, AGT, etc. at the beginning of motion
The train went from Regina to Banff until several years ago.
Destination (DEST LOC): intended or actual location of PAT at cessation of motion
The train went from Regina to Banff., He fired at the target but missed.
Recipient (RECIP): person who receives Transfer PAT
I gave the bomb to Sergeant Bailey., I inherited an ancient Egyptian curse
Verbal recipient (VBL RECIP): the entity who receives the Verbal PAT (words, song, etc.)
Dick said to Jane, "the hill is too steep. Spot can't make it."
Referent (REF): the limits of a state or process
They studied as hard and as long as they could., They were as happy as they could be.
Result (RES): the state of the PAT after a process
He carved the starship Enterprise out of hickory wood., The students in his semantics class were brilliant after he showed them his theory of three-dimensional semantics.
Stimulus (STIM): the entity which triggers a psychological state
Fear of Friday the 13th kept her home., Photos of Desiree sent Melvin into rapture.
Telic (TELIC): the purpose of action or motion
He left to get a sandwich., He avoided the market due to the crowds.
Time or Temporal (TIME):
subtypes:

Duration (DUR TIME): length of time
Desiree tanned topless on the beach for three hours.
Point (PT TIME): locus in time
On Friday she caught the cruise ship home.
Start (START TIME): initial temporal boundary
They sipped piña coladas on Sunday from three to six.
Finish (FIN TIME): final temporal boundary
The dusty cowboys sat in the bar till closing time.
Vehicle (VEH): means of motion
Desiree and Brent took a slow cruise ship to Jamaica.

Here are a few Upriver Halkomelem sentences showing how such semantic roles and logical operators unify the semantic elements in the sentences.
From "The Story of the Flood," told by Daniel Milo to Oliver Wells, January 6, 1964:
a.) siyə́m l siyə́yə, yáswə lɛcxʷ pípətlàxʸ.
(dear)(my)(friend)(maybe)(you're going to) (recognize me a little)
VOC REF EXP TIME:STRT PSYCST PAT:ST REF
My dear friend, maybe you'll recognize me a little.

b.) tə?ílə sxʷoxʷiyə́·m kʷsəs lə wóq'ʷ tə téməxʷ k'ʷə ?íɬ.
(this is) (story) (when it) (was) (drowned)(the)(earth)(which)(past)
REF ST:EX PAT:ST TIME:PT PAT:PROC TIME:PT PROC PAT:PROC
This is the story of when the earth of the past was drowned.

c.) t'ə́·l k'ʷə lɛct ɬq'ə́ləxʷ təlí kʷθə táym.
(went out of sight)(what) (we're going to) (know it) (from)(that)(time)
PAT:ST EXP TIME:STRT PSYCST PAT:ST TIME:STRT
PROC PAT:PROC
What we would know from that time went out of sight.

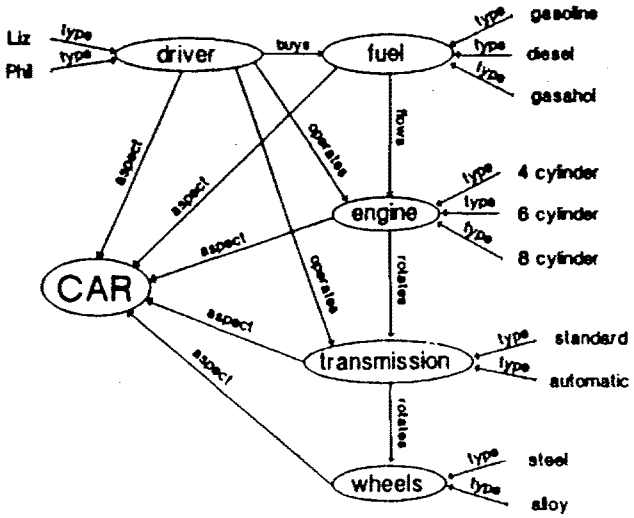
d.). lálək'ə swíyəqə təlíls ɬəq'ə́ləxʷ kʷs wóq'ʷcɛ tə téməxʷ.
(there's one person)(male)(he definitely)(knows it)(that) (it will drown)(the)(earth)
PAT:ST PAT:PROC TIME:STRT PROC PAT:PROC
ST:EX EXP REF PSYCST PAT:ST
There was one man who definitely knew that the earth would drown.

e.) ?ásu θə́tstxʷəs tə sí·yə́yəs, tə məstíyəxʷ,
(so) (he told them)(the)(his friends)(the)(person/people)
REF AGT VBL RECIP:VBL
"θiyə́mcɛp k'ʷə sləxʷəɬ ?iyá·ləm xʷələ́m kʷθɛ mə́mələ, kʷθə qə́x mə́mələ́s."
(you folks make)(a)(canoe)(right/correct)(for)(your)(children), (the one who)(has lots)(his children)
AGT PROC PAT:PROC REF BEN AGT
PAT:VBL
So he told his friends, the people, "You folks make a canoe
right/good enough for your children, those who have lots of children."

Notice how modifiers have added their content to the modified in semantic roles. Also notice that with embedded sentences or phrases, two levels of semantic roles must be shown. Words and embedded roles are underlined. Connections also could be used to show things joined in single semantic roles.

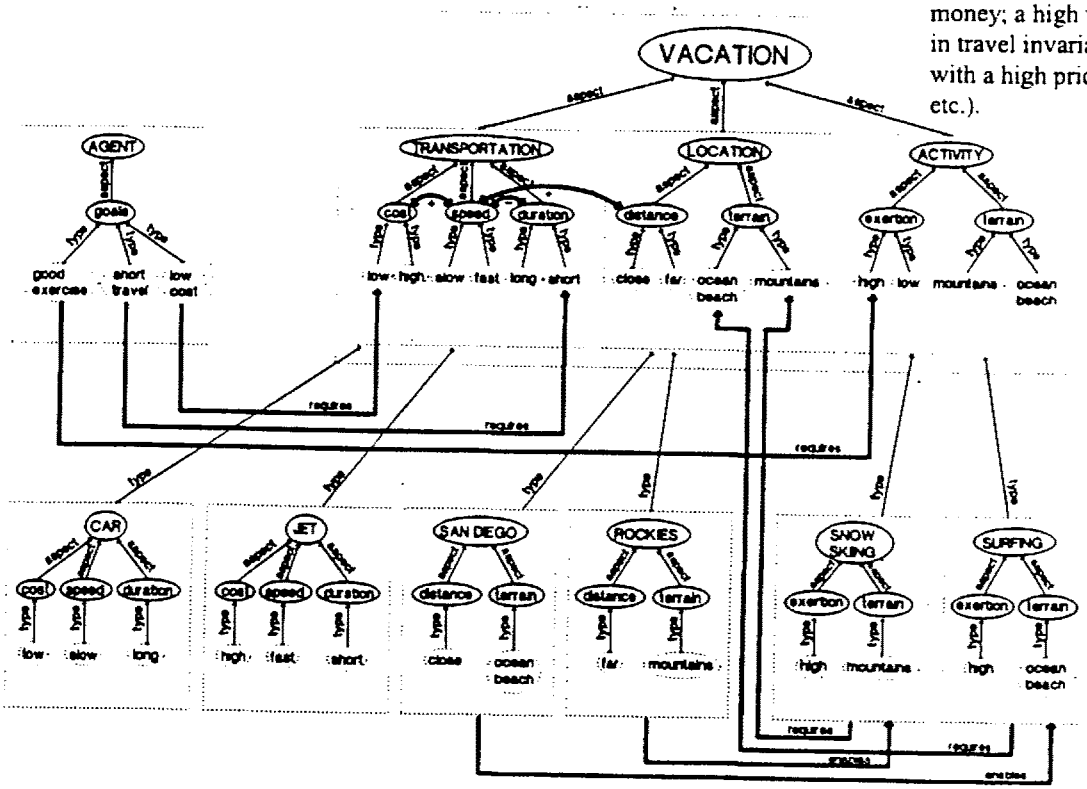
6 Cognitive Frames for Upriver Halkomelem

Cognitive frames (Barsalou 1992) are extremely versatile and can show the cognitive basis for Halkomelem exemplars, prototypes, taxonomies, conceptual combinations, stories and other speech events, event sequences, rules, plans and decision-making. A few examples from Barsalou show their usefulness. An example following those show how they are useful in seeing connections in Upriver Halkomelem as well, in this case for the first lines of the story which is analysed above in the section on semantic roles. Notice how most of the connections in these frames are labelled, some with verbal functions (driver buys fuel, transmission rotates the wheels, etc. in the first diagram), some with covert subdomain labels (TYPE, ASPECT, ATTRIBUTE). Aspects and attributes are about the same thing here and are flexible enough that they often show (less-weighted) connections that a term has in other domains than its main one.

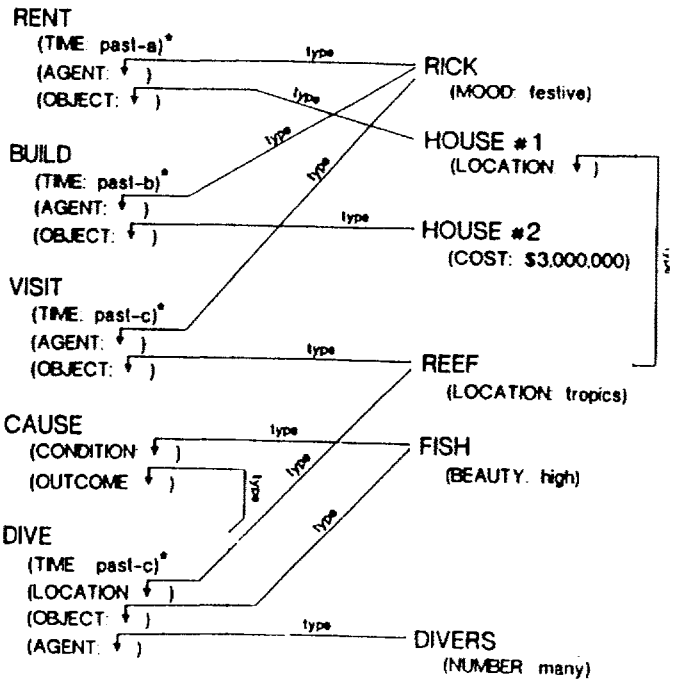


The first frame shows how frames can be used to show how some things work together, experientially.

The second frame show how a number of important factors in making decisions about a vacation interrelate. It also shows that some of the relations are structurally invariant, some are attribute constraints, some are value constraints, and some are contextual constraints (travel by plane enables a longer vacation but requires more money; a high value of speed in travel invariably is linked with a high price of travel; etc.).

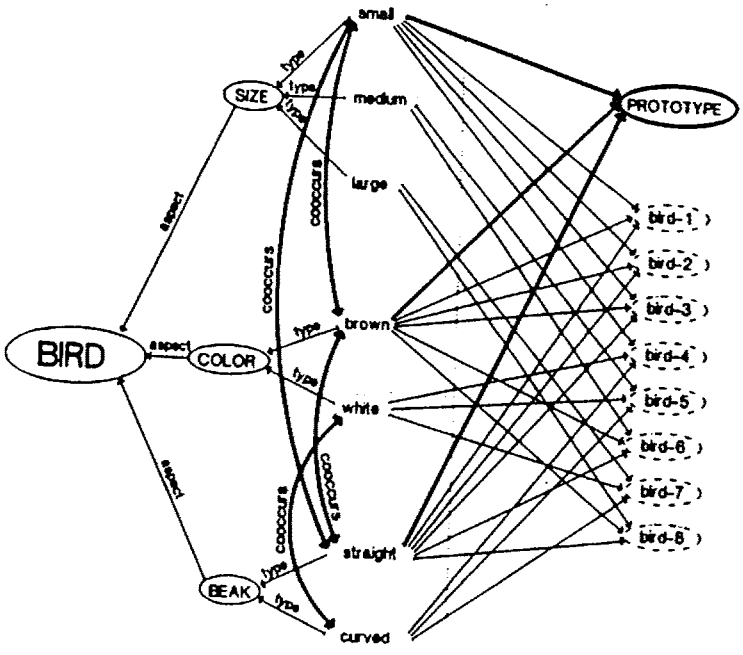


Rick, feeling festive, rented a house near a tropical reef. He had recently b
house worth three million dollars. Rick had visited the reef long ago. The fis
been beautiful, and many divers were present (pp. 210–211).



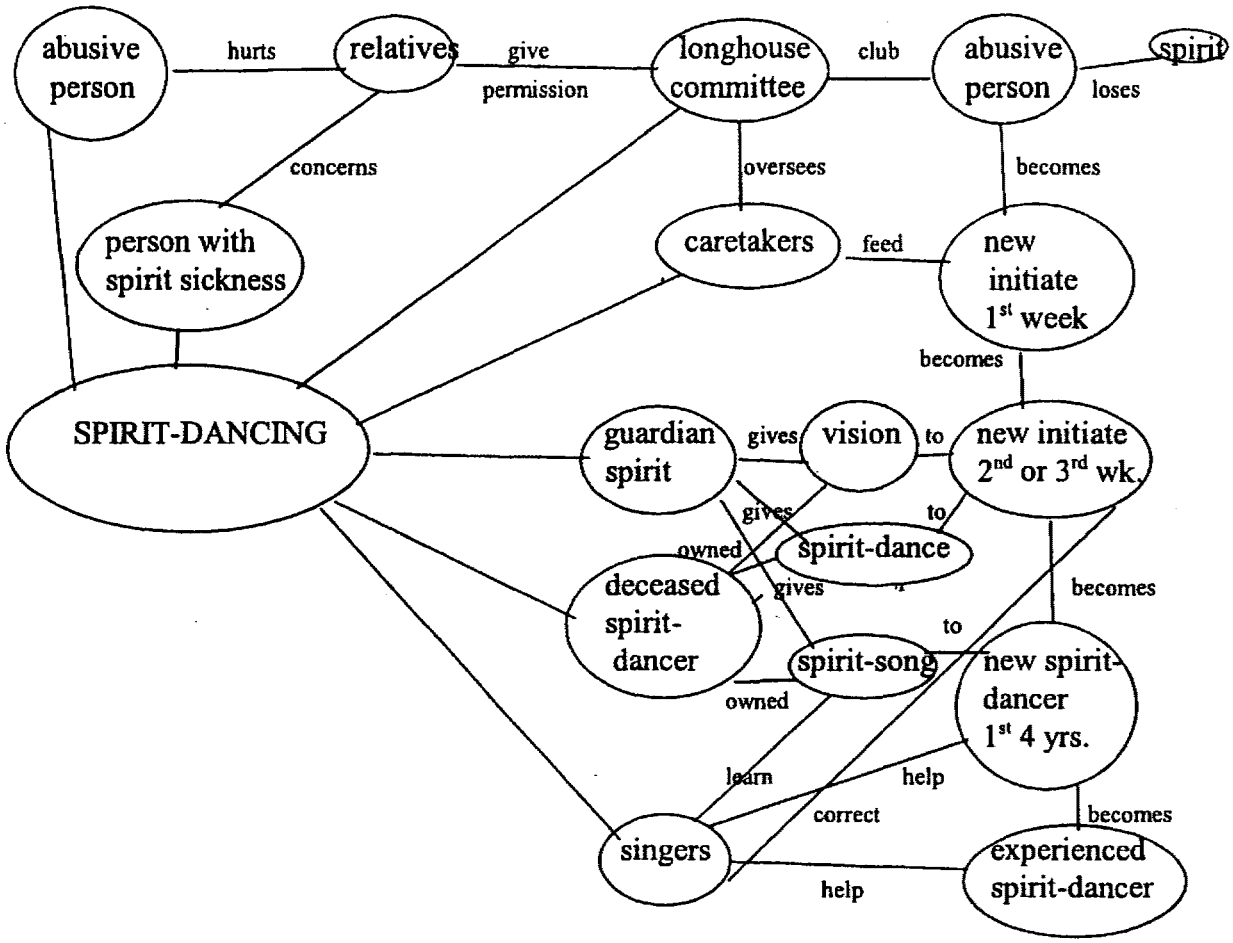
* time-c < time-b < time-a

This frame shows the conceptual frame and connections involved in a short story. The actions are given in the right column and the participants in the left. Semantic roles are shown under the actions with connections to the participants who may fulfill different semantic roles at different times in the story. The chart here is a bit messy because I wrote in some more precise and more complete semantic role names that could replace or be added for some of the terms for a more complete picture.

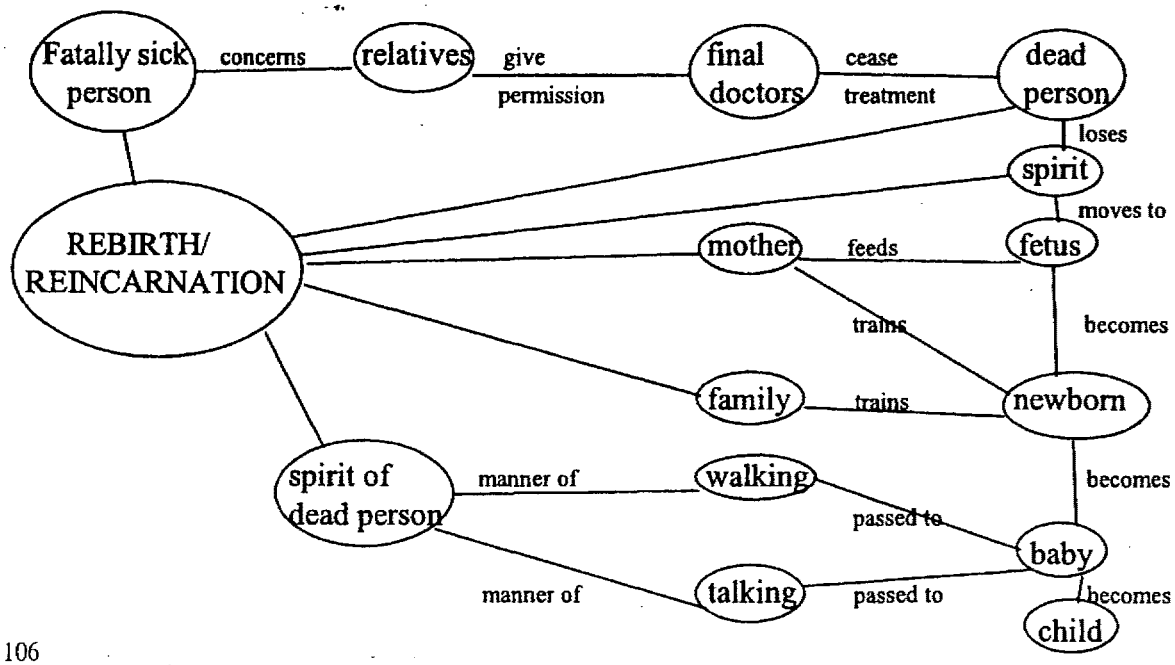


This frame shows how specific values of attributes of birds can be drawn for a variety of birds and the majority values for each attribute can then be linked to show the values of the bird that would be prototypical for a particular set.

Cognitive Frame for Spirit-Dancing



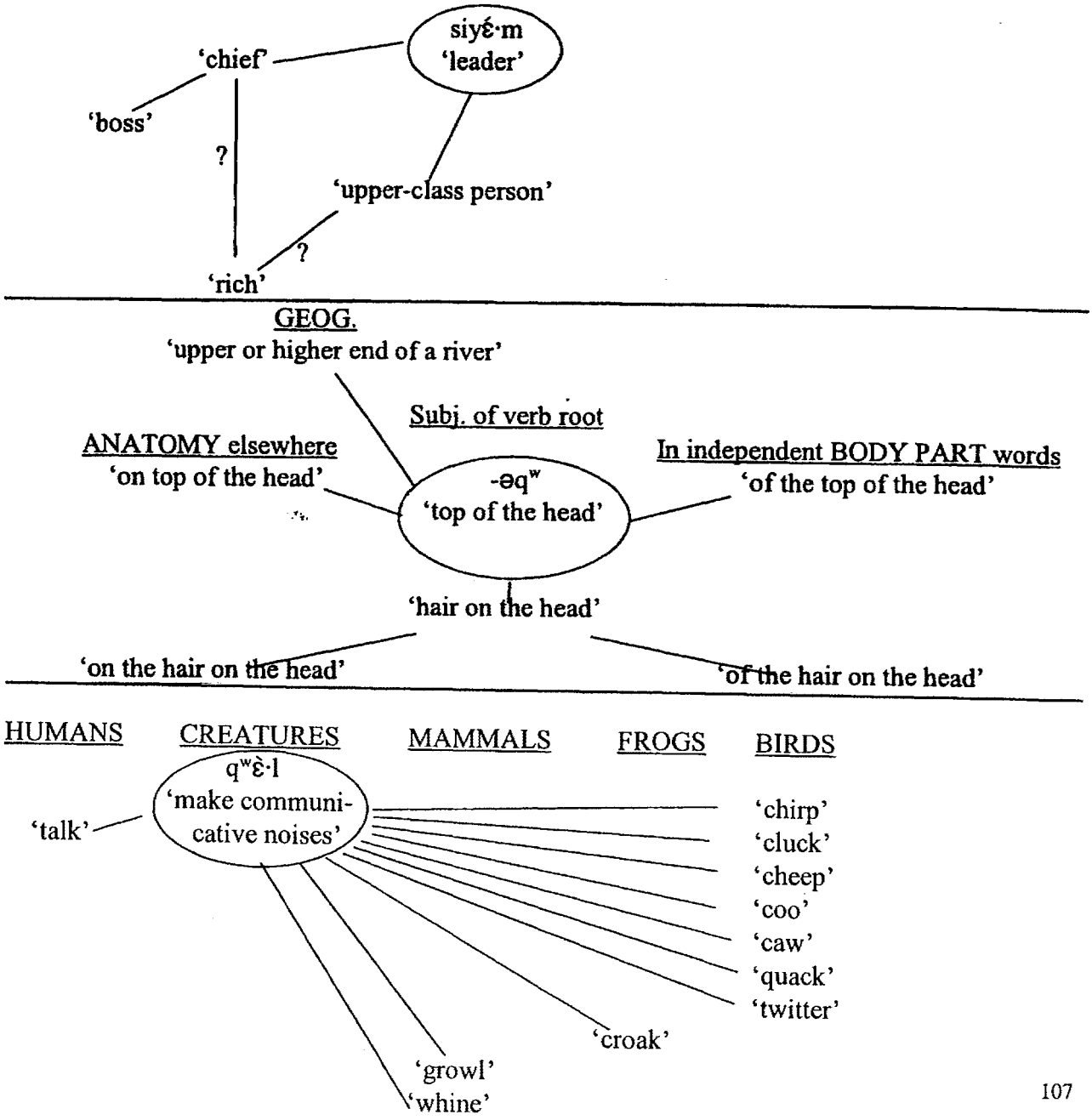
Cognitive Frame for Rebirth/Reincarnation

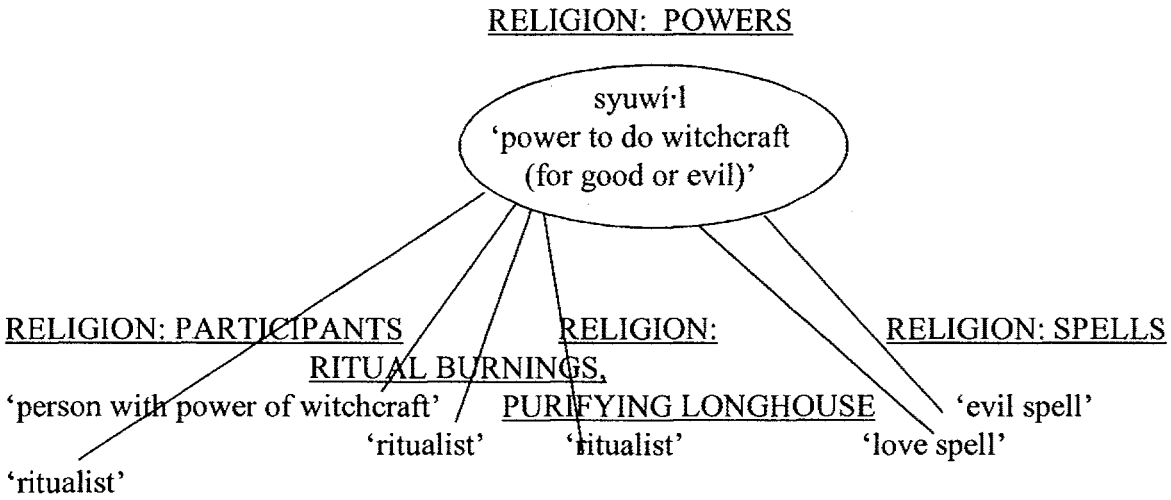


7 Cognitive Image Schema for Upriver Halkomelem

Image schema (as in Lakoff 1987) are shown for allosemes of several Halkomelem words. Most show a central meaning/alloseme with radial allosemes. There are also some cases of allosemes in chains of meaning. Due to chains some allosemes may not share a common semantic component; however, since allosemes are defined in 3-D Semantics as being meanings (of a morpheme, word or idiom) which are semantically similar and in complementary distribution in the semantic environment, the similarity in such cases is seen through chains of meaning. Notice an innovation in some of these cognitive image schema is that the strongest domain connection of the allosemes is also shown. Implied behind this is that such schema link to the neural network patterns of activation of the domains involved with each alloseme.

Some Radial categories and Chains in Upriver Halkomelem





8 Use of Neural Connections with Multiple Areas of the Brain: Sense connections (visual, auditory, tactile, olfactory, gustatory), episodic memory and pragmatic knowledge.
Fromkin (1987), Lakoff (1987), and other researchers in neurolinguistics have pointed out that as a speaker or hearer is engaged in language interchanges he/she uses connections in the brain with semantic memory, the visual, auditory, and where appropriate the tactile, olfactory, and gustatory, emotional and episodic memory portions of the brain. These give access to pragmatic and experiential knowledge that is essential in using language as we do. The brain has a biological imperative to always try to make sense of all the information it receives. It does this by parallel simultaneous processing and by not insisting on ruling out all possible alternatives, but by just quickly finding the most likely explanation (this is where Chomsky and others using Truth-Conditional Semantics and binarism have failed–those things do not bear any relation to the richness and reality of the system that has been established by researchers in cognition). Where no explanation is found for some of the information, the brain shrugs (metaphorically) and lets those unanswered questions waits until more information may made integration and interpretation possible. It is busy making sense of new incoming information from all channels.

9 Future Directions and Consequences.
More and more linguists interested in a realistic view of semantics, which is informed by scientific discoveries about the brain and cognition, are working in various versions of cognitive semantics and are starting to integrate these approaches. Lakoff 1987 led the way. Langacker's Cognitive Grammar 1987 and 1991 and ff. apply cognitive image schema and other techniques to grammatical meaning as well as lexical meaning. Palmer 1996 is another outstanding example, integrating cultural knowledge and world view, discourse and narrative, metaphor and metonymy, and cognitive grammar. Hinkson 1999 is another outstanding work, applying cognitive image schema to show and predict how all the various allosemes of each Salish lexical affix are related. In developing Integrated Cognitive Semantics (ICS) I intend in the future to also integrate several of the approaches above, namely Cognitive Grammar and Cultural Linguistics. Though I have not attempted it here, I look forward to doing some cognitive image schema and cognitive frames with weights shown on the connections. Connectionists have done some work to devising

formulae for calculating weights on connections, and further improvements may be possible as brain research with PET scans reveals more details on how strongly activated those sections of the brain are that are being used, just as it is revealing where and what sections of the brain is being used as cognitive and linguistic tasks are being done.

One of the important consequences of all this work is that, like the work of Lakoff and Johnson (1980 ff.) and Lakoff (1987 ff.), it shows that autonomous syntax, decontextualized sentences, the reliance on Symbolic Logic, and in fact Chomsky's whole Transformational Generative Grammar approach were misguided, unrealistic, and unworkable in the light of scientific approaches to linguistics. Autonomous components and rule sets in TGG are just not realistic and do not reflect how the brain works. Many Structuralists ignored syntax during the 1950's and 1960's and thus Chomsky won his battles with many of them (not with Hockett, nor with most Amerindianists, including myself, and not with a number of European and American linguists). My 3-D Semantics can be seen as an invigorated and flexible form of Structuralist Semantics, just as Lakoff's work since Lakoff and Johnson 1980 can be seen as an invigorated form of generative semantics. However, syntax must be informed by cognitive semantics, as Lakoff 1987 insists. Functional syntax seems to be heading in the right direction to replace TGG and, though TGG supporters are legion, TGG must simply be radically changed or abandoned if we care about scientific research into language and abandon the philosophical approach that has proved incapable of providing an adequate account even of English, which it has centered on for 40 years.

References

Ashcraft, Mark H. 1989. *Human Memory and Cognition*, Harper Collins Publishers.

Barsalou, Lawrence W. 1992. "Frames, Concepts, and Conceptual Fields," in *Frames, Fields, and Contrasts, New Essays in Semantic and Lexical Organization*, ed. A. Lehrer and Eva Kittay. pp.21-74.

Chafe, Wallace L. 1970a. *Meaning and the Structure of Language*, University of Chicago Press.

Chafe, Wallace L. 1970b. "A Semantically-Based Sketch of Onondaga," *IJAL*, 36.2: supplement, Indiana University Publications in Linguistics and Anthropology, 25.

Cottrell, G. 1989. *A connectionist approach to ux)rd sense disambiguation*. Los Altos, CA: Morgan Kaufmann.

Dillon, George L. 1977. *Introduction to Contemporary Linguistic Semantics* (Prentice Hall)

Feldman, J. A., & Ballard, D. H. 1982. "Connectionist models and their properties." *Cognitive Science*, 6,205-254,

Fillmore, Charles N. 1968. "The Case for Case," *Universals in Linguistic Theory*, ed. E. Bach and R. Harms, pp. 1-90, Holt, Rinhart and Winston.

Fillmore, Charles N. 1982. "Frame Semantics," *Linguistics in the Morning Calm*, pp. 111-38, Linguistic Society of Korea.

Fromkin, Victoria A. 1987. "The Lexicon", *Language*, 63.1:1-22.

Galloway, Brent D. 1993a. *A Grammar of Upriver Halkomelem*, University of California Press, UC Publications in Linguistics, 96

Galloway, Brent D. 1993b. "Three-Dimensional Semantics", unpublished ms.

Galloway, Brent D. 1998 draft. Dictionary of Upriver Halkomelem, unpublished.

Galloway, Brent D. 1999. "Some Semantic Roles in Canadian Assiniboine/Nakoda," paper given

at the 19th Conference on Siouan and Caddoan Languages, SIFC/University of Regina, Regina, Sk.
Galloway, Brent D. 2000. "Cognitive Semantics in Halkomelem", a paper given at the 39th Conference on American Indian Languages at the American Anthropological Society Annual Meetings, San Francisco, Ca.
Gasser, M. 1988. *A Connectionist Model of Sentence Generation in a First and Second Language*, (Technical Report UCI,A-Al-88-13). Los Angeles: University of California, Los Angeles. Computer Science Department,
Gasser, Michael . 1990. "Connectionism and Universals of Second Language Acquisition", *Studies in Second Language Acquisition*, 12,2:179-199).
Gazzaniga, Michael S. 1989. "Organization of the Human Brain," *Science*, 245: 947-52.
Grimes, Joseph. 1979. *The Thread of Discourse* (Mouton)
Hinkson, Mercedes Q. 1999. "Salish Lexical Suffixes: A Study in the Conceptualization of Space." Ph.D. thesis, Dept. of Linguistics, Simon Fraser University.
Kanerva, P 1989. *Sparse Distributed Memory.* Cambridge, MA: MIT Press.
Lakoff, George 1987. *Women, Fire, and Dangerous Things.* University of Chicago Press.
Lakoff, George and Mark Johnson 1980. *Metaphors We Live By*, University of Chicago Press.
Lamb, Sidney 1966. "A Stratificational Approach to Structural Semantics," *Current Anthropology*,
Langacker, Ronald W. 1987. *Foundations in Cognitive Grammar, I.* Stanford University Press.
Langacker, Ronald W. 1988. "Review of Women, Fire, and Dangerous Things by George Lakoff," *Language*, 64.2: 384-95.
Langacker, Ronald W. 1991. *Foundations in Cognitive Grammar, II.* Stanford University Press.
MacLaury, Robert E. 1986. *Color in Mesoamerica, Vol. I: A Theory of Composite Categorization*, Ph.D. Thesis, University of California, Berkeley
MacLaury, Robert E. 1987. "Coextensive Semantic Ranges: Different Names for Distinct Vantages of One Category," *Chicago Linguistic Society*, 23 (I):268-82.
MacLaury, Robert E. 1991. "Prototypes Revisited," *Annual Review of Anthropology*, 20:55-74.
MacLaury, Robert E. 1995. "Vantage Theory," *Language and the Cognitive Construal of the World*, John R. Taylor and Robert E. MacLaury, eds., New York: Mouton de Gruyter, 231-276.
McClelland, J. L., Rumelhart, D. E., & PDP Research Group (Eds.). 1986. *Parallel Distributed Processing. Explorations in the Microstructures of Cognition: Vol. 2. Psychological and Biological Models.* Cambridge MA: MIT Press.
Nida, Eugene 1975. *Componential Analysis of Meaning*,
Palmer, Gary B. 1996. *Toward a Theory of Cultural Linguistics*. Austin: Univ. of Texas Press.
Palmer, Gary B. 1997. "Foraging for Patterns in Interior Salish Semantic Domains," in Ewa Czaykowska-Higgins and M. Dale Kinkade: *Salish Languages and Linguistics*. New ;York: Mouton de Gruyter.
Perlmutter, David M. 1983, 1984. *Studies in Relational Grammar*, vols. 1 and 2 (University of Chicago Press)
Posner, Michael I., Steven E. Petersen, Peter T. Fox, and Marcus E. Raichle 1988. "Localization of Cognitive Operations in the Human Brain," *Science*, 240: 1627-31.
Rumelhart, D. E., Hinton, G. E., & Williams, R. J. 1986. "Learning Internal Representations by Error Propagation," eds., D. E. Rumelhart, J. L. McClelland. & the PDP Research Group, *Parallel Distributed Processing. Explorations in the Microstructures of Cognition,: Vol. 1, Foundations* pp. 319-362. Cambridge, MIT Press.
Tulving, Endel and Daniel L. Schacter 1990. "Priming and Human Memory Systems," *Science*, 247:

301-06.
Waltz, D. L. and J. B. Pollack. 1985. "Massive Parallel Parsing: A Strongly Interactive Model of Natural Language Interaction," *Cognitive Science*, 9:51-74.