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Multimodal Communication of Specialized Knowledge across Hypertext Innovation and Generic Tradition

Abstract

As more and more educators try to employ interactive texts in the educational process, investigation of how knowledge communication takes place in hypertext becomes increasingly significant. Drawing on a multimodal theoretical framework, this paper explores knowledge communication in interactive texts from the *Volcano World* website (<http://volcano.und.edu/vwdocs/Online/index.html>). The analytical focus is first on how specialized knowledge is multimodally constructed inside the generic framework of traditional lessons through different types of interactive exchanges and across several semiotic modes. Second, the analysis discusses how the linear reading path imposed by the generic structure of traditional lessons is disrupted by hypertext's meaning-making pathways. The paper concludes that the stable generic structure of lessons combined with the openness of hyperlinks can be and, to some extent, is being exploited in websites like *Volcano World* to enhance the process of progressively acquiring, producing and exchanging specialized knowledge across several semiotic modes. By detecting the kind of meaning-making structures that can be established when communicating specialized knowledge in a hypertext environment, educators can continuously adapt online interactive texts to accommodate students accustomed to complex interactive activities and eager to get to grips with them.

1. Introduction

This paper's premise is that a discussion of communication of specialized knowledge must recognize that interactive texts rely on the meaning-making integration of several semiotic modes. Language, image and sound are co-deployed to position users as actively engaged co-

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authors of specialized knowledge. The significance of this cannot be underestimated as learning processes must be customized not so much in terms of the specific goals and requirements of educators, but rather those of the new generations of:

The multiliterate children [who] can simultaneously process and monitor multiple displays of specialized knowledge on the computer screen [who] can search for, retrieve and store specialized knowledge across several semiotic modes and media in a matter of seconds. (Maier et al. 2007: 455).

Drawing on an interdisciplinary theoretical framework, this paper explores knowledge communication in interactive texts on the *Volcano World* home page (<http://volcano.und.edu/vwdocs/Online/index.html>). The analytical focus is: a) on how specialized knowledge is constructed multimodally within the generic framework of traditional lessons across several semiotic modes through different types of interactive exchanges; b) on the innovative ways in which the linear reading path imposed by the stable generic structure of traditional lessons is disrupted by meaning-making pathways that facilitate knowledge communication at several hypertext levels. This reveals how, by adapting traditional notions of generic structures to the possibilities of hypertext, specialized knowledge can be communicated in innovative ways.

2. Data

A specific segment of the *Volcano World* website made up of several interactive lessons is the main object of analysis. Accessible from the *Teaching and Learning* home page in the *Volcano World* website, these lessons are grouped on the *Volcano World Online* home page under the title *Online Education Programme*¹. The five interactive lessons², the heart of the *Volcano World Online* web page, are designed specifically for interaction via the web and via email thereby accommodating the needs of both parties: the aims and requirements of educators and the

1 The website is a Collaborative Higher Education, K-12, and Public Outreach project of the North Dakota and Oregon Space Grant Consortia administered by the Department of Geosciences at Oregon State University.

2 A further lesson, *Internet Conferencing*, can be accessed through a hyperlink from the *Vacation Excitement* lesson, but the multimodal analysis of that lesson falls beyond the scope of the present paper.

knowledge level and interactive expertise of the students.

The home page explains that:

One goal of Volcano World is to provide students and teachers with lessons about volcanoes. Even if you are not a formal student or teacher you might find something interesting. Here are a few lessons and activities to get you started. Keep an eye on this page. We'll be adding many more lessons as fast as we can.

The lessons are sequential, cover introductory volcano topics and are designed to take about 50–60 minutes.

1. Vacation Excitement! – The mountain where the students are vacationing wakes up.
2. Monitoring Volcanoes – Presents two ways to measure volcanic deformation.
3. Volcano Hazards – Looks at ash and mudflows and the hazards they present.
4. VOLC News – Invites students to produce a 5 minute internet news cast about an active volcano.
5. Eruption Simulation – Invites students to experience the drama of a potential volcanic eruption in your community. Plan community, business and political responses to ensure your survival.

Each lesson can be accessed through a hyperlink on the *Volcano World Online* website and consists primarily of a text displayed on the first page of each lesson containing several hyperlinks. In this way, information is both directly displayed on the home page of each lesson but can also be accessed and created through links to other home pages or websites. The interactive goals are displayed for educators on the *Participant Interaction* home page. Lessons are meant to encourage:

- working co-operatively in groups to solve problems;
- sending emails to other participating classes;
- asking *VolcanoWorld* experts and other participants questions;
- posting completed lessons, graphics and questions to a website;
- submitting new volcano study ideas.

3. Interdisciplinary framework

Before presenting the analysis and its results, some observations need to be made concerning the interdisciplinary framework employed, which focuses on both genre analysis and multimodal analysis. This analytical choice is motivated by the specific nature of the *Volcano World Online* lessons characterized by their well-defined generic structure, the subject matter and the good use to which hypertext's affordances are put, all of which means that the sequence of generic stages is dynamically and multimodally expanded on several levels capturing an extremely diverse range of verbal and visual structures.

3.1. Multimodality

Meaning-making structures are realized in texts through and across several semiotic modes. In fact, most of the communicative landscape has always been multimodal³:

The purely mono-modal text has always been an exception while the core practice in communication has essentially been multimodal all along. The dominance of linguistics, however and the concentration of language as the central mode, paired with a lack of adequate models for the analysis of other modes, made verbal mono-modality appear to be the standard and dominant form of communication (Stöckl 2004: 10).

When analysing various challenging aspects of the multimodal and multimedia contexts of the contemporary educational process, multimodal researchers such as Kress et al. (2001), Kress/Jewitt (2003), Lemke (1998 and 2000) and Snyder (2001 and 2002) have clearly demonstrated the possibility of expanding our understanding of complex educational texts through the multimodal approach.

The main reason for adopting multimodality in this analysis is that it employs a unifying metalanguage that can address the meaning making resources of language and image as well as their multilayered relationships in complex texts. As Kress and van Leeuwen (2001) explain, a multimodal approach can show how meaning produced by a certain semiotic mode can be duplicated, complemented, reinterpreted or even

³ According to Kress, "mode is the name for a culturally and socially fashioned resource for representation and communication" (Kress 2003: 46).

subverted through the simultaneous deployment of several other semiotic modes⁴.

While there is general agreement as regards the co-deployment of several semiotic modes, the variety and complexity of data has meant that semiotic modes have been differentiated, labelled and interpreted in a variety of ways. Without denying the significance of all the possible modes in the meaning making process, for practical reasons, I have chosen to focus in the first stage of my analysis on just the visual and verbal modes taking ‘visual mode’ to mean images and layout, and ‘verbal mode’ to mean all the verbal features displayed on the homepage, whether spoken or written.

Van Leeuwen’s system (2005) of multimodal relations is adopted in this paper as it clearly systematizes the main categories of relations that can be established between the visual and the verbal modes and includes the following: elaboration through specification and explanation, extension through similarity, contrast and complementation. Van Leeuwen’s model demonstrates how multimodal relations can “*make the items of information coherent in relation to each other in such a way that they become relevant, that they become knowledge you can do something with*” (van Leeuwen 2005: 247). Additionally, following van Leeuwen (1991, 2005), Maier (2006) explains how the complex interplay of the multimodal relations can define and position recipients of multimodal texts in various ways. Science writers and educators use these categories of multimodal relations when choosing effective visuals to structure visual knowledge and position their students who “*are encouraged to establish complex relations between verbal and visual types of information, and thereby acknowledged as active users*” (Maier et al. 2007: 474). Furthermore, a description of these relations can be useful for science writers and educators because they “*can work with the systematic categorization scheme to make educational decisions based on functions derived from the interaction of the text with the visuals*” (Maier et al. 2007: 464). In the case of the Volcano hypertext, the dynamic process of engaging students as active users in the online educational proc-

4 A series of researchers in multimodality have explored the relations between several modes in various types of complex texts: van Leeuwen (1991, 2005), Lemke (1998), Royce (2007), Lim (2004), Macken-Horarik (2004), Martinec/Salway (2005), Baldry (2005), Unsworth (2006), etc.

ess is a good example of how multimodal analysis needs to be complemented by genre analysis as we shall see in the next section.

3.2. Genre theory and hypertext levels

Most systemic linguists approach genre from a functional perspective considering that genre is “*a staged, goal-oriented, purposeful activity*” (Martin 1984: 25). Additionally, the current paper is supportive of the view that: “*each stage in the genre contributes a part of the overall meanings that must be made for the genre to be accomplished successfully*” (Eggs 1994: 36). Baldry/Thibault (2006: 114) stress the fact that “*the idea of genre as a staged, goal-oriented schema comprising a particular sequencing of functional components – both optional and obligatory – is less appropriate for talking about web page genres*”. While agreeing with Baldry and Thibault’s findings, the template idea of genre is appropriate for the website analysed here as it is made up of several lessons organized in terms of a recognizable structural template in keeping with Hasan’s notion of “generic structure potential” (Hasan, 1996). The generic structure potential “*is designed to highlight the variant and invariant properties of textual structures within the limit of one genre*” (Hasan 1996: 52).

The reason for choosing this website is precisely that it exemplifies the tension existing between the old structural template of a traditional lesson and the new flexibility of the hypertext which can creatively exploit this traditional approach. In other words, the website shows how a particular generic schema specific to an “old genre”, namely the classroom lesson, can be employed in the new context of the hypertext where “*the emphasis is to a much greater extent on variability, flexibility, and multitasking*” (Baldry/Thibault 2006: 117). Thus, this instance of interactive text employs generic features typical of the conventions of classroom lessons while giving educators and students multiple possibilities to communicate and create specialized knowledge through a variety of hyperlinks. These navigational elements transform the static structure of the lesson genre into a dynamic one by allowing users to establish their own hypertext trajectories⁵. The implication of opening

5 Baldry and Thibault argue that trajectories in hypertext are “meaning-making pathways” that progressively integrate “*the semiotic resources that are encountered as the website user progresses from one linked object, one text, one web page, one website to the other*” (Baldry/Thibault 2006: 116).

up several meaning-making pathways to create specialized knowledge may be viewed as follows:

as the hypertext trajectory unfolds, it expands into a much larger-scale semiotic formation in which diverse genres, modalities, web pages and websites are progressively integrated with each other (Baldry/Thibault 2006: 116).

In this paper, the discussion of the multimodal interaction between generic stages and the hypertext may be viewed in relation to the constraints dictated by the type of hypertext that is mainly to be found in Internet – *static hypertext* – which does not possess the adventure-game features of *dynamic hypertext*. Baldry et al. (1994) point out that the dynamic hypertext can be used in a variety of educational contexts to represent knowledge on three separate planes: the metalevel, the strategic level and the tactical level⁶. Bearing in mind that the web page analysed here uses *static* hypertext and cannot therefore distinguish between these three knowledge planes with the elegance of dynamic hypertext with its use of techniques born in artificial intelligence, we can nevertheless apply this model in our attempts to understand how generic templates are used in Internet in an attempt to achieve the same goals. In the interpretation given here of the model proposed for dynamic hypermedia by Baldry et al. the metalevel corresponds to the template of the lessons' generic structure. It is designed by the creators of the lessons. This metalevel is made visible through the names of each generic stage of the lessons and their specific logo images. All knowledge constructed on the other levels of the hypertext has to be interpreted by users according to the constraints imposed by the metalevel. The strategic level is represented by the concrete application of the template according to the specific communicative purposes and activities of each lesson. Access to the tactical level is achieved by clicking on the hyperlinks existing on the strategic level in the generic structure of the lessons. In a dynamic model, access to the strategic level is dependent on the user's activity on the tactical level; in other words the specific trajectory followed is both memorized and scored with pages of theoretical reflection belonging to the strategic level opening up *only when* a specific trajectory – e.g. a correct as opposed to incorrect trajectory – has been

6 Baldry et al. (1994) apply these concepts for the first time in the exploration of conversational interaction through dynamic hypermedia.

adopted by the user. A synchronization between planes that differs with, and is dependent on, each user's pathway through the materials is not possible in static hypertext. However, to a certain extent through the use of generic templates, it is in part possible to recreate some of the affordances of dynamic hypertext in static hypertext. This would appear to be what is happening in the case of the chosen website. How then is the guidance achieved in dynamic hypertext recreated in Internet web pages? The suggestion made here is that it is the metalevel that both controls the generic structure on the strategic level and monitors the interpretation of knowledge accessed in different parts of the tactical level. The tactical level can be differentiated in several sublevels according to the hyperlinks embedded in its texts and images.

By focusing on how the semiotic modes enter into complex meaning-making relationships in the hypertext trajectories in each generic stage and across them, the specific ways in which the generic stages are multimodally expanded in the hypertext levels can be revealed, highlighting how hypertext positions the students as active users and producers of specialized knowledge when allowing them to act and interact beyond the conventions of a classroom lesson.

4. Findings

4.1. Types of generic stages

This section introduces aspects of the generic structure of the interactive lessons with special focus on the communicative purposes of each generic stage of the lessons.

The lessons are structured as a sequence of generic stages organized as a range of instructions that are supposed to be followed if certain goals are to be achieved. The instructional information about the lessons' stages and their purposes are displayed on the main page of each lesson, while the more specific specialized knowledge about volcanoes can be accessed from the generic stages through the hyperlinks. The fact that specialized knowledge can be accessed, constructed and used only after reading the instructional information implies that the process of navigating through the hypertext is structured and targeted for the achievement of well-defined learning goals. The five lessons are char-

acterized by a clear structural homogeneity, as the structure of each interactive lesson is made up of the following generic stages:

Leading Question, Key Concept, Objectives, Surf Sites, Materials, Procedure, Optional and Encouraged. The **Leading Question, Key Concept, Objectives, Materials** and **Procedure** stages are obligatory, while **Surf Sites** and the last two stages are optional.

The appearance of the optional stages in the structure of the lessons is motivated primarily by the lesson's overall purpose. If that purpose is accomplished through the obligatory stages, then optional stages are excluded, some of their specific communicative purposes being taken by the remaining obligatory stages. For example, the optional status of the *Surf Sites* stage is not to be motivated by the fact that the stage is attributed less importance for the success of conveying the proposed communicative purposes of the whole lesson.



- Mount St. Helens Eruptive Activity
- The Two-Month Precursory Period
- Short Cut to Problem Solving

Figure 1. The Surf Sites stage in the *Eruption Simulation* lesson

The other stages also include links to other home pages, websites or other media, thereby achieving the communicative goals of the *Surf Sites* stage in more specific ways in keeping with these stages' main communicative purposes. In that way, users are encouraged to surf the hypertext in several stages of the lesson for different purposes. The placement of the *Surf Sites* generic stage immediately after the *Objective* stage ensures immediate access to a wider and flexible landscape of specialized knowledge even before going through the activity steps proposed in the *Procedure* stage.

All the stages are characterized by certain communicative purposes and communicative strategies. Apart from the *Surf Sites* stage, all the

generic stages convey both information concerning the educational process involved in each lesson and specialized knowledge concerning the respective subject area. Table 1 demonstrates the relations between the types of generic stages and the specific communicative purposes when conveying information to the users:

Types of Generic Stages			Communicative Purpose
No.	Obligatory	Optional	
1.	Leading Question		To concisely state the purpose of the lesson
2.	Key Concept		To introduce the topic of the activity
3.	Objectives		To indicate the main tasks of the students To provide evaluation through e-mail contact with the experts
4.		Surf Sites	To facilitate access to specialized knowledge existing on other pages of the site
5.	Materials		To provide (information about) the materials that are to be used
6.	Procedure		To provide detailed instructions about the main steps of the activity To provide linking of school sites to Volcano World To receive reports from users for evaluation by experts To provide access to video materials
7.		Optional	To provide detailed instructions about the main steps of another possible activity To receive information during internet conference To provide e-mail contact among participants
8.		Encouraged	To provide access to video materials To provide linking of school sites to Volcano World

Table 1. Generic Stages and Communicative Purposes

All the generic stages are meant to accomplish their communicative purposes either directly on the home page of the lesson in question, or indirectly by facilitating access to knowledge that exists on other home pages, websites or another media. The process is multimodally organized through a dynamic network of links and a complex system of cross referencing. In other words, the communicative purposes of the lessons are attained by following the linear reading path imposed by the

generic structure of each lesson but also by other means. The relevance of the hyperlinks in the context of the stable generic structure has to be taken into account because the communicative goals mentioned in Table 1 cannot be attained without making use of the hyperlinks. Only by employing the meaning-making pathways opened up through the hyperlinks available in different generic stages is it possible to access, construct and communicate the specialized knowledge afforded by the lessons.

4.2. Generic stages and semiotic modes

Having presented the generic structure of the interactive lessons, I now turn to the semiotic resources through which the functions of each generic stage are achieved. These are accomplished either through the resources of the verbal mode or through the relations of these resources with visual ones. Certainly, the two modes vary in the degree to which they convey, receive and facilitate exchange of various types of knowledge. However, in this website there is no significant spatial or temporal precedence in the process of accessing information through the two modes as, with the exception of the *Objectives* generic stage, in all the other generic stages, both the verbal and the visual mode are simultaneously at play. It could be claimed that in the *Objectives* generic stage the visual mode is also represented, but only through the typography of its title because no photos or hyperlinks are introduced in its structure. The communicative load is carried mainly by written text in stages like *Leading Question* and *Key Concept* as the only image that accompanies the verbal resources are the logo type images which identify the specific stages for the users.

A further exception is the *Procedure* stage in the lesson *VOLC TV News Team* which has no visual elements. However, in this stage, the text is crowded with imperatives that connote the visual mode: *draw*, *tape*, and *digitize*. In all the other stages, both verbal and visual resources in various combinatory structures facilitate the sharing of knowledge.

Generally, the written texts in the lessons are visually characterized by a clear compositional homogeneity, as they have similar layout, typography and color-scheme, and each particular generic stage has the same title and is accompanied by the same logo type image in all les-

sons. Visual homogeneity together with verbal similarities reflected in the titles of the stages strengthens the well-defined structure of each lesson. Furthermore, it is this recurrence of the stages' titles and logo images that motivates the existence of a metalevel in the hypertext. Through hyperlinks existing at the strategic level in the different generic stages, the users can reach the tactical level with other types of visual and verbal structures through which specialized knowledge about volcanoes is communicated. In the similar generic stages of the different lessons, these visual and verbal structures reached through the hyperlinks no longer have similar compositional features. Consequently, the multimodal composition of the lessons is also multilayered.

On the strategic level, users can read about each stage of the lesson, but are also given signals through the hyperlinks that they are not to be constrained by the linear progression of the generic stages. In this way, by following the various hypertext trajectories, the user is confronted on the tactical level by various structural and compositional elements belonging to the verbal and visual modes. By clicking on this level's images, they can reach a further tactical level on which they can magnify the respective images so as to study them in detail; they can also access other images and/or texts. As well as accessing specialized knowledge about volcanoes, knowledge about constructing specialized knowledge gained. For example, the *Problem Solving Model* through which the users are instructed about the steps in a problem scenario and get accustomed with concept mapping.

The way in which users are supposed to employ these hyperlinks creates meaning-making pathways across hypertext levels, semiotic modes and media. The way in which semiotic modes are combined in and beyond the different generic stages of the five lessons confirms the traditional "functional specialization" of the two modes highlighted by Kress:

"if writing is better for representing events in sequence, and image is better for representing the relations of elements in space, then it is likely that each will be chosen according to what it is best for" (Kress 2003: 46).

For example, the functional differentiation of the two modes is certainly obvious in the *Problem Solving Model*. If the steps are presented ver-

bally like the stages of the lessons, then the mapping of concepts is visualized through coloured nodes and labelled lines.

4.3. Types of images

The next step in my analysis is to identify the main types of images existing in the generic stages of the lessons.

There are three main types of images embedded in the various levels of the interactive lessons: images of logo types, images related to activities and images related to volcanoes.

The three categories of images are employed to mediate the exchange and production of specialized knowledge. On the lessons' homepages, the recurrent images that accompany each and all the generic stages with the exception of *Objectives* stage are the logo type images that identify for the user what type of instructive information is to be expected in each generic stage. As specific images always accompany the same generic stage in each lesson, they also visually signal the generic homogeneity and connections existing between all five interactive lessons. Table 2 shows examples of the three types of images existing in the interactive lessons:

	Types of images	Examples
1.	Images of logo types	
2.	Images related to activities	
3.	Images related to volcanoes	

Table 2. The main types of images

Two lessons, *Volcano Hazards* and *Monitoring Volcanoes*, include on their homepages both photos displaying materials that have to be used during the activities and photo showing the progression of activities in the *Procedure* generic stage. The *Monitoring Volcanoes* lesson also includes a photo displaying materials that have to be used during a new activity in the *Encouraged* stage. All the other types of images can be accessed from the lessons' homepages through following the hypertext trajectories on other levels of the hypertext.

Table 3 shows the types and subtypes of images existing in the interactive lessons:

Types of images	Subtypes	Generic stages
Logo type images	Drawings related to the topic of each generic stage	All generic stages (with the exception of <i>Objectives</i>)
Images relating to the lesson's activities	Photos displaying materials to be used during the activities	<i>Materials, Procedure</i>
	Maps of imaginary/real locations and volcanic activities (mudflow, ashfall, etc.)	<i>Materials, Procedure</i>
	Data record sheets	<i>Materials, Procedure</i>
	Concept maps	<i>Surf Sites</i>
	Tables for daily volcano reports	<i>Materials, Procedure</i>
	Photo showing progression of activities	<i>Procedure</i>
	Photos displaying results of activities	<i>Procedure</i>
Images related to volcanoes	Photos of types of volcanoes	<i>Surf Sites, Optional</i>
	Photos of volcanoes' elements (dome, lava, ash, etc.)	<i>Surf Sites, Optional</i>
	Photos of volcanoes in different eruptive periods	<i>Surf Sites, Optional</i>
	Moving images of volcanoes' eruptions	<i>Materials, Encouraged</i>
	Maps of volcanoes' locations	<i>Materials, Procedure</i>
	Maps and graphics of eruptive episodes	<i>Materials, Procedure</i>
	Satellite and thermal images of volcanoes	<i>Surf Sites</i>

Table 3. Types of images and generic stages

As can be seen in Table 3, the visual resources embedded in the structure of different generic stages at the various levels of the hypertext are not only images that should be looked at/viewed, and images which have to be studied and worked on, as for example, the imaginary maps,

the data record sheets and tables for daily volcano reports. In this way, students are encouraged to participate in a process of knowledge creation and visualization.

4.4. Multimodal relations

Generic stages in these websites are multimodal rather than linguistic; they are recurrent meaning-making units whose role and position in the sequence of knowledge communication is predictable.

On the metalevel, the main relation between the title of the generic stages and the accompanying images is one of **elaboration through specification**. This relation is established also between images of logo types of the metalevel and the written texts of the strategic level as the written text specifies the particular meaning of that type of image in the context of a certain lesson. These images together with the similar layout, and the names of the generic stages visually link the specific generic stages from all the lessons making them recognizable for users. On the strategic level of two lessons, *Volcano Hazards* and *Monitoring Volcanoes*, there are also other relations of **elaboration**, as their *Procedure* stage is accompanied by photos of the progression of classroom activities, while in the other lessons only links to other home pages or materials are available in that generic stage. The relation between those images on the strategic level of the *Procedure* stage is one of **elaboration through explanation** as each image or sequence of images paraphrases the instructive information conveyed through the verbal mode. The relation between those images is one of **temporal extension** as the temporal progression of the respective activity is visualized in the sequence of images.

The relationship of **extension** between parts of the strategic level's text existing in the obligatory stages and images from the tactical level is mainly one of **complementation**. By using hyperlinks, users can access images which meaningfully complement certain parts of the strategic level's text because these images add further information to the text. The same hyperlinks are also resources for further multimodal texts and classroom activities. For example, reusable materials such as data record sheets, the tables for daily volcano reports and the concept maps that are linked to *Materials* can be downloaded, printed out and duplicated. If in the *Materials* stage, users are encouraged to perform these

activities, in the *Procedure* stage those links are made available once again, but this time users are encouraged to plot those materials. In this way, the relations of complementation between text and images in the *Procedure* stage contribute to the transformation of the active users of the multimodal text in producers of specialized knowledge that can be further communicated.

Table 4 illustrates a sample of the typology for describing ways in which multimodal relations are connected to the obligatory generic stages of an interactive lesson and its purposes:

Generic stages	Communicative purposes	Image types	Multimodal relations	
			Types	Subtypes
<i>Leading Question</i>	To concisely state lesson's purpose	Logo type image	Elaboration	Specification – text makes image more specific
<i>Key Concept</i>	To introduce the topic of the activity			
<i>Objectives</i>	To indicate students' main tasks			
	To provide evaluation through e-mail contact with the experts			
<i>Materials</i>	To provide (information about) materials to be used	Hyperlink – data record sheet	Extension	Complement – the content of images adds meaning to text
	To provide access to video materials	Hyperlink – video material		
	To provide (information about) materials to be used	Hyperlink – maps	Elaboration	Specification – the image makes the text more specific
<i>Procedure</i>	To provide detailed instructions about the activity's main steps	Photos series – activity progression	Extension	Complement – the content of images adds meaning to text
	To provide materials to be used	Hyperlink – data record sheet		
	To provide video materials	Hyperlink – video material		
	To provide materials to be used	Hyperlink – maps	Elaboration	Specification – the image makes the text more specific
	To provide volcano photos	Hyperlink – volcano photos	Extension	Logical – similarity

Table 4. Multimodal relations in obligatory generic stages of the interactive lessons

In the optional generic stages, the hypertext trajectories facilitate these types of multimodal relations, as well as other types due to the specificity of the communicative purposes of the respective generic stages.

The extension relationships of **complementarity** between text and images are accompanied by other types of relations between series of written texts and series of images on the further tactical levels of the hypertext because in the optional stages users are confronted with a wider choice of hypertext trajectories. For example, by clicking on one of the links in the *Surf Sites* generic stage of the *Volcano Hazards* lesson, users can access a series of images accompanied by texts or/and hyperlinks. By clicking on the image with the superimposed title *Geological History*, users can access a co-present series of similar images superimposed on the main image.

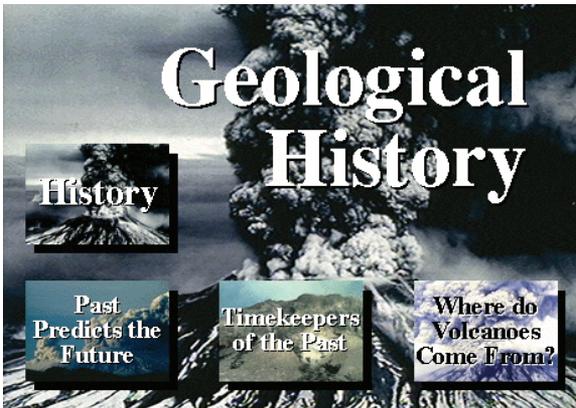


Figure 2. Image from the *Volcano Hazards* lesson

The relationship between main image and main written text is one of **extension through complementation** as the image adds meaning to the main text. Those superimposed images are accompanied by texts that enter into a relationship of **logical extension** with each other. As far as their relations with the accompanying texts are concerned, it is obvious that they are relation of **elaboration through specification** because texts make the images more specific.

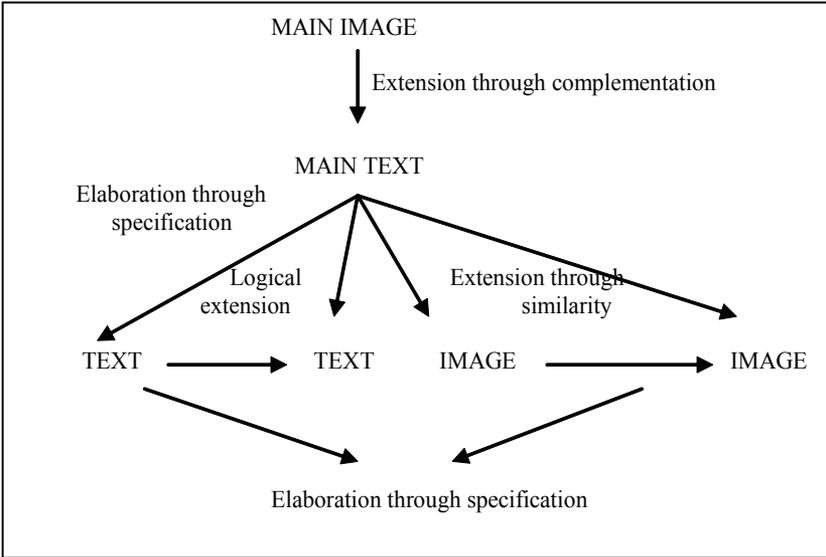


Figure 3. Multimodal relations in *Geological History* image

The multimodal and multilayered system of relations expands the frames of the generic structure when structuring specialized knowledge. The diversity of multimodal relations and the complexity of image types also indicate through what semiotic resources knowledge can be communicated in and beyond the generic stages, and how knowledge is expected to be accessed and used by the participants. Furthermore, as students are expected to establish and employ these multilayered relations between verbal and visual modes in and across generic stages and hypertext levels, they are also acknowledged as potential participants in the process of producing specialized knowledge.

Table 5 illustrates a typology to describe ways in which multimodal relations are connected to the optional generic stages of an interactive lesson and its purposes:

Generic stages	Communicative purposes	Image types	Multimodal relations	
			Types	Subtypes
<i>Surf Sites</i>	To facilitate access to knowledge existing on other pages of the site	Hyperlink – photos of volcanoes (types, elements and eruptive periods)	Extension	Logical – similarity Temporal – next event
		Hyperlink – concept maps		Complement
		Hyperlink – imaginary maps	Elaboration	Specification – the image makes the text more specific
<i>Optional</i>	To provide detailed instructions about the main steps of another possible activity	Hyperlink – photos of volcanoes (types, elements and eruptive periods)	Extension	Logical – similarity Temporal – next event
<i>Encouraged</i>	To provide access to video materials	Hyperlink – video material	Extension	Complement
	To provide information about materials to be used		Extension	Complement

Table 5. Multimodal relations in optional generic stages of the interactive lessons

5. Conclusion

In the interactive *Volcano World Online* lessons, a closed generic template is employed to explain how to structure classroom activities when knowledge about volcanoes is communicated and created. At the same time the openness of the hypertext levels is exploited to enhance the process of progressively acquiring, producing and exchanging specialized knowledge across semiotic modes and media. The employment of a generic structure in the static hypertext of Internet partly compensates for the absence of the dynamic nature of classroom activity, that dynamic hypertext is able to mimic, and, when appropriately employed, gives users the possibility to maintain the logic of a coherently organized

class activity in spite of the myriad of possible hypertext trajectories offered through the hyperlinks. Furthermore, specialized knowledge can be multimodally co-produced by active users only when knowledge is communicated and exchanged through these hyperlinks. Providing live online educational opportunities inside the structure of the interactive lesson, the creators of the *Volcano World Online* have managed to achieve one of their main goals, namely to promote “the mastery of the internet and not be a slave to it”. Due to the existence of the well-defined generic stages of the lessons, hypertext trajectories are embedded in the web pages and have to be followed in order to attain the purposes of each lesson stage and not for the sake of simple surfing. The fact that same hyperlinks can be employed in different stages of different lessons for different purposes implies and strengthens the position of users as active participants in the process of constructing and producing specialized knowledge.

This paper has attempted to highlight some of the advantages of applying a multimodal analysis on the generic structures of online educational texts. The generic structure of the interactive lessons has been described and the types of images have been classified in order to reveal the categories of multimodal relations that can be established across generic stages and at different hypertext levels along meaning making trajectories.

By being aware of the meaning making potential of these multimodal relations, educators can employ them strategically as criteria for building hypertext trajectories that encourage all aspects of the production and communication of specialized knowledge. By detecting the kind of meaning-making structures that can be established when communicating specialized knowledge in a hypertext environment, educators can continuously adapt online interactive texts to accommodate students eager and well-equipped to engage in complex interactive online activities.

As argued, it may be concluded that the interplay of several modes can and should be strategically employed and exploited by educators when positioning their students in the interactive environment of the hypertext in order to facilitate efficient communication of specialized knowledge.

Through further multimodal analysis, the complex relations of the visual and verbal modes with other modes like sound, for example, could also be highlighted in similar generic structures. Apart from that, the multimodal approach could be adopted by educators to critically select those multimodal structures and relations that respond to the needs of other target groups and/or the requirements of other subject areas of specialized knowledge.

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