Subjectivity in the Ivanhoe Game: Visual and Computational Strategies

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Johanna Drucker, in her contribution to this collection, reminds us that the task of Ivanhoe's interface is not merely to offer a visual representation of subjectivity, but instead to create an interactive matrix in which it can be enacted and performed, and where its results are emergent at the intersection of multiple subjectivities in dialogue. But what might emergent intersubjectivity look like? How might we respond to and fuel its representation through critical engagement with texts and documents and with a community of interpreters? Computationally and in terms of design, how would such an interface function? What visual cues might players need in order to engage with the Ivanhoe Game in a manner appropriate to its own theoretical stance regarding the social and autopoietic instantiation of creative works?

These concerns may at first seem far removed from the painstaking tasks involved in the creation of digital archives and electronic editions: content modeling, text and image markup, and the development of clear and useful interfaces. In fact, the core problem facing any digital implementation of the Ivanhoe Game is identical to that which plagues the construction of more conventional electronic archives and editions: how may a rich visual environment, suitable to the expression of documentary particularity, be made to work in concert (and not just in parallel) with a rich computational environment, suitable to the transformation and analysis of texts?

But the case of Ivanhoe is special. Because it is figured as a game with a formalized (or formalizable) ruleset, the needs of users and their modes of interaction with the textual and spatial environment that makes up Ivanhoe are perhaps more explicit and easy to enumerate than the needs and actions of most users of electronic editions. Chief among these is the requirement, crucial to the playing of the game, that players be able to locate themselves and their peers – the subjective viewpoints from which all their interpretative contributions stem – at every moment of their interaction with the digital resource. This sort of interpretive mapping makes possible new, perspectival insights into the texts at hand and into the emer-

gent hermeneutic project of the entire playing community. Furthermore, when careful representations of the self and of subjective relations among players and the texts they both react to and transform are designed in the same visual language, a beneficial state of flow in gameplay (and therefore in critical thinking) may be achieved. The spatialized texts presented through this interface open themselves to *response in kind* by players; that is, players learn to manipulate, navigate, and transform the discourse field seamlessly, because they are made to feel a part of it.

Visual embodiments of subjectivity and intersubjectivity in preliminary Ivanhoe models come in many forms. Each of these has been designed to meet specific needs related to perspectival positioning:

> core visualizations must be fundamentally self-centered, in that users are able to locate themselves and appreciate game-related state changes to their avatars quickly;
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> this self-centeredness can only exist in an obviously social context, in which meaning emerges in the comparison between personal points of view and the visualization of other perspectives;
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> the interface must allow for fluid and personalized regions of activity, always expressed visually and including spaces for reading, writing, evaluating, and navigating;
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> the gamespace must retain an emergent character in keeping with the constant transformation of a generative and collaborative hermeneutic project;
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> and the graphic design of game elements must facilitate a sense of response in kind in that players immediately grasp the relation of visual representation on the screen to modes of action in gameplay.

The combination of these fundamental requirements, all of which must be laid on a solid foundation of text-analytical functionality, challenges us as the developers of the Ivanhoe Game to go far beyond the state of the art in interface design for text-based electronic archives and annotation engines. The simple, yet highly self-conscious *addition of multiple subjectivities to*

information visualization promises to enhance our interpretive engagement with electronic resources. In this way, Ivanhoe parallels its sister-project at the University of Virginia's SpecLab, Temporal Modeling (Drucker and Nowviskie). It is our hope that all the experimental work in tool design for humanities computing now going on at SpecLab will help demonstrate the inherent hermeneutic possibilities of digital environments. We should not limit ourselves to an understanding of electronic archives and editions that excludes interpretation and scholarly engagement from their very constitution as they appear before us on a screen. These structures need not be mere static repositories of information.

This essay will examine some designs for what the SpecLab team has come to call "Ultimate Ivanhoe," an implementation of the game that takes full advantage of the graphic and interactive possibilities of a spatialized and subjective discourse field, and which permits players to navigate, contribute, and respond to changes in that field using the same visual vocabulary that constitutes it. Chief among these are concepts such as the *evolving avatar*, a changing map of player activity that comes to represent the player himself and thereby exert a subtle influence on his gameplay by heightening self-consciousness, and the navigable dimensional display or *discourse field*, a shimmering network of linked textual nodes that can be drawn into the foreground or pushed into the background depending on the player's interest and focus. These designs are relevant not only to the building of an Ivanhoe prototype, but may offer insight into new methods for editing texts in graphical environments – just as the game itself may point to new ways of analyzing and presenting existing (often underutilized) resources such as digital archives.

But what do we mean by subjectivity in the context of a visual interface to textual activities? This is of course a loaded question, which I have answered already in part by figuring the content of an Ivanhoe session as *textual activity* rather than as textual information or resources. The Ivanhoe Game asks its users to create on-screen content as readily as they access it. Our latest interface sketches go so far in emphasizing the constructed nature of the textual universe that every request for a text view is explicitly represented – or in fact merely *revealed* – as a calling-forth along specified algorithmic or procedural lines. In Ivanhoe, there is no text that simply is, that simply waits to be accessed by a disengaged reader. Every text view is instantiated as a result of collaborative actions among a player, his human co-interpreters (we shun the word "opponents," but some versions of Ivanhoe may usefully twist collaboration into ludic competition),

and the machine that responds to his actions by producing aesthetic provocations – algorithmically-derived visualizations – that feed back into game play in a strange, dialogical loop.

Any textual object which depends for its constitution as obviously on the physical as on the mental actions of a human user provides for a kind of performative subjectivity, a transformational condition in which personalized practices of use become (in Jerome McGann's term) *deformative* and perhaps revelatory of embedded narratives, constellations, and meanings (McGann and Samuels). Of course any book whose cover you open opens itself up to your personalized interpretation in this way. And some of the most performative branches of textuality – gematria, Kabalistic text generation, and much of the procedural work that has come to be called *ars combinatoria* – offer suprisingly few opportunities for the insertion of subjectivity into their heavily proscribed generative practices (Zweig). Interface designs for the Ivanhoe Game attempt to make clear the degree to which *every textual embodiment is the result of a series of performative and therefore interpretive acts, all done from a particular perspective, defined visually as subjective origins of display*. Ivanhoe goes further, emphasizing the collaborative and constantly evolving nature of these displays as a means of rehabilitating the proscriptively algorithmic image of deformation and combinatorial work. Deformance is not, as it is commonly understood and criticized, a thing a machine can do without oversight and which produces an alien and decontextualized object. Instead, we wish to enact textual deformance in constant collaboration with a social group of interpreters, within the hermeneutic contexts (or "discourse fields") they define through their actions, interactions, and subjective positionings. The machine provides nothing more than a facilitating environment, offering computational and visual aids to scholars intimately familiar with the interpretive practices of their craft. Its responses are not answers.

So subjectivity in the Ivanhoe Game emerges as a consequence of actions and interactions, all of which derive their meaning from the self-conscious positioning of players relative to their peers and to the arranged documents in play. The simplest form of this positioning comes about when players choose roles – fictive personalities or perspectives through which to offer all their contributions to play – at the outset of a game. (This open-ended precondition is in itself a form of *ars combinatoria*, resulting in games in which minor characters from the novel at hand might challenge the new readings of dead literary critics and appeal for support

to a weird conglomeration of printer's devils, Catholic schoolgirls, and other forces of Nature.) The requirement that players make their moves from the defined perspective of a particular role is meant to demonstrate the perspectival or subjective character of all interpretive acts; no interpretation is uninflected, disembodied, or without context. Roles do not, however, enter the game as simple substitutions for the points of view of their owners. Ivanhoe's ruleset and interface emphasizes the self-consciousness of interpretation by maintaining tension between player and role. Perspectives (and therefore visual subjectivities) must remain bifurcated in order to force the kind of reflection the Ivanhoe Game is meant to promote.

In terms of the game's basic functionality, the overlaying of roles onto a player's (sometimes-secret) self-identity requires a separation between public and private spaces. Players maintain private "role-journals," in which they document and articulate the inner logic that compels their public performance. Masks are worn in public – but not too tightly – where player moves are attributed both visually and textually to their roles and where most forms of direct engagement among players are mediated through the concept of the role. That is to say, in typical gameplay (where one textual contribution or move responds to another), players act entirely in the voices of their roles. The game does, however, provide opportunities for out-of-character interaction in the form of challenges and evaluations. Like the required role journals, special fields for challenging others' moves and evaluating the contributions of one's co-interpreters reinforce through their very presence a perspectival difference between a player and his role.

How might perspectival difference be usefully expressed in a visual environment such as Ivanhoe? First we must differentiate among types of perspective or points of subjectivity. The Ivanhoe Game implicitly asks players to differentiate themselves from their co-interpreters by presenting them with a space for social textual production. We might imagine a digital environment in which contributions to a shared interpretive project are unattributed, and in which the emergent text almost seems to evolve of its own accord. Ivanhoe adopts the opposite strategy, marking individual contributions to a communal interpretive field so heavily that the field itself seems to be inflected by personality and subjective response. Each individual's game-play (or interpretive response) is therefore of necessity shaped by the actions of his peers, as he struggles to escape or gamely submits to the gravity wells of their subjective contributions. But Ivanhoe's interface makes explicit calls on players as well, as it

asks them to differentiate themselves from their adopted interpretive roles. I will revisit this brand of perspectival difference in a later discussion of the evolving avatar system.

We therefore have three types of subjectivity which could support visual expression in the game: players must differentiate their embodiments in the gamespace from the influencing presence of other players, must differentiate their roles' perspectives from those of other roles, and (perhaps most interestingly) must differentiate themselves as interpretive forces from the subjective, performative positions of their own adopted roles. Does this suggest that three display modes should be implemented for each player, essentially three lenses through which the discourse field might be viewed? Depending on the development of play in any game instance, each of these views might offer useful information (read: aesthetic provocation) to the player, which could feed back into his next interpretive action in an unexpected, even delightful way. But I return to the problem of defining subjectivity in the context of Ivanhoe's visual matrix. Thus far we have established that *subjectivity in Ivanhoe emerges through embodied action and perspectival differentiation*, which suggests that subjectivity, as it has long been figured in game studies and by theorists of virtual environments, is contingent on a participant's sense of "presence." Is presence a necessary precondition to the generation of subjective viewpoints? In a visual and computational context, can concepts in question be defined by their opposites? What, in this case, is the opposite of presence? The opposite of visualized subjectivity?

Software engineers and the designers of virtual environments have developed a twofold approach to the problem of subjectivity, which has become increasingly vexing as real-time, networked, collaborative computing and the development of distributed suites of integrated applications grow in prevalence. The approach (as is common) splits itself along the line of the interface, and drives development on the one hand of computationally subjective structures within or in parallel to the object-oriented systems which predominate software engineering. On the other hand, VR theorists and designers work to create subjective interfaces for collaboration in virtual environments, interfaces that expand on the inherent perspectival sensitivity of VR to enable truly individualized experiences in which one participant's view may differ from another's in more than physical point-of-view. I will combine an overview of the issues confronting interface designers in computer supported cooperative work with a discussion of computational subjectivity within and in resistance to the

object-oriented paradigm.

The classical model which informs object-oriented systems holds that the behavior and properties (sometimes called the *state*) of an artifact is inherent or intrinsic to itself or to the class of objects to which it belongs. All users of objects and all system components must share a single view or definition of each object, which supports a useful kind of global predictability about behavior. That is to say, a particular invocation or command made upon an object will result in the same behavior regardless of the source of the call or the contexts, classes, and states of the object and its invoker. However, situations exist in which subjective views of and calls on shared objects are desirable. Not all of these involve, as does Ivanhoe, human collaboration; instead, the users may be system components or a single machine or human user at different points in time. The first workshop on subjectivity in object-oriented systems, a joint 1994 effort by IBM and Sun Microsystems, cited four such potential uses for subjective views of shared objects: 1) the construction of growing suites of applications leads to individualized needs for extrinsic properties and behaviors that cannot be derived efficiently from intrinsic qualities of the object; 2) multiple views of shared data have become increasingly desirable, and display routines need not always be based on intrinsic properties when, in fact, they can be written as separate applications; 3) versioning, or different states associated with a single object, could be considered as a form of temporal subjectivity if users could store a single reference without a need to update it to account for the latest (or some important past) version; and 3) debugging and software development would be enhanced by subjectivity if different perspectives on an application could be safely stored and accessed (Harrison et al.). The potential benefits of subjective orientation extend to our philosophical model of objects as well. Bent Bruun Kristensen points out that "subjective behavior would support more autonomous and evolutionary objects" because it not only enables but *assumes* multiple and changing states of objects, their contexts, and the users or applications that invoke them (Kristensen).

Software engineers focused on the problem of subjective enhancements to object-oriented systems are sensitive to philosophical and historical understandings of subjectivity. They appreciate that "allowing objects to present multiple views to different clients" is only a "first step towards subjectivity... True subjectivity requires that separate views contribute towards or even constitute the definition of the object" (Harrison et al. 132). This realization is in keeping with "non-classical philosophical trends that

emphasize the idea that subjective perception is more than just a view filtering some objective reality," but rather that the perception "adds to and transforms that reality so that the world as perceived by a body of perceptive agents is more than the world in isolation" (Harrison and Ossher 143). Such concepts of subjective perception assume the involution of an observer with the external objects he observes, a notion supported by our current understanding of the functioning of our senses as physical organs, and by the autopoietic theories of Maturano and Varela which have come to be central in the development of the Ivanhoe Game and its interface (see Jerome McGann's contribution to this collection) (Maturana and Varela).

Interface designers who wish to incorporate subjective features into shared virtual environments are likewise becoming more sensitive to the relationship between vision and perception. Contrivance of an apparently objective perceptual experience is the central task confronting most branches of VR research and development; therefore, potential inconsistencies between users' internal mental models and the "self-evident," visible world (inconsistencies which in fact *constitute* our daily experience) have traditionally been treated as problems to be overcome. Instead, conventional VR systems "attempt to model a fundamentally objective shared reality, and to present that reality to its users as being synchronized and definitive" (Pettifer and West 170). Pettifer and West point out the fundamental unattainability of such a goal, which falters even when confronted by network lag times that prevent perfect synchronization (let alone differences in hardware and external environmental factors that contribute to subjective understanding of a communal environment). To some extent, then, designers must accept and could perhaps even exploit "ostensibly 'shared and common' worlds that are actually different within certain tolerances for each participant" (Pettifer and West 170).

In geographically-oriented virtual spaces – spaces that seemingly replicate real-world environments – the temptation has been to assume that simple, independently-controlled viewpoints which result in perspectival differences based on pitch and proximity can fully express user subjectivity. Early literature on virtual reality congratulated the technology for advancing beyond the WYSIWIS ("what you see is what I see") paradigm that dominated two-dimensional multi-user interfaces based on a shared desktop or whiteboard metaphor. The notion of "relaxed WYSIWIS" promoted by Stefik really amounted to basic user customization, in which a shared interface could be tailored to personal preferences through a small number of optional commands (Stefik et al.). Gareth Smith suggests that a

small measure of such visual customization (choosing the shapes, visibilities, and colors of entities, for example), when coupled with the inherent perspectival nature of spatialized VR, is sufficient to meet the needs of users for subjective yet shared experience (Smith 392ff.). In this way, all users employ a broadly identical representation of a dataset and "thereby trade flexibility for the ability to collaborate in the use of the information" (Snowdon and Jää-Aro, "How Not to Be Objective" 1.3).

Yang and Olson take a similarly moderate approach to the problem of subjectivity in VR interfaces, concentrating on issues of navigation. They identify a danger to collaboration involved in "taking subjectivity to the extreme," and warn that the destruction of shared contexts is an almost-inevitable result of viewer-dependent visual representation (Yang and Olson 2.1). Despite acknowledging tensions between collaboration and individualized perspective, the results of their study of cooperative tasking in a multi-user environment do favor the use of what they term "egocentric perspective displays." These findings about collaborative navigation are important for the development of the Ivanhoe Game in that they address enabling a variety of desirable approaches to a shared dataset: a "divide-and-conquer" approach, in which users exploit subjective views in order to complete a shared task; the practice of space-partitioning, in which areas of action or influence are identified and boundaries are maintained; and the assigning of different roles to individual users, from which perspectives they participate in a group task (Yang and Olson 3). The critical prerequisite to enabling personalized or subjective views that do not hinder users' ability to function collaboratively is that the system support awareness of the actions and perspectives of others.

Typical aids to perspectival understanding in shared environments have taken the form of graphical markers on the avatars of one's collaborators. In this model, avatars are represented within a common, bird's-eye view of the digital space. Headlights, view cones, or nose rays indicate the spatial orientation or gaze of the collaborators. A convergence of headlights indicates a convergence of interest (Benford, Greenhalgh et al.). Sometimes, users are given the option of switching among their own subjective perspectives, a third-person shared view of the space, and (less commonly) the private view of a peer. All of these tactics are thought to bear on the problem of navigation, which has become the chief interest of much subjective and perspectival research in collaborative virtual environments.

How, in such contexts, is navigation defined? Spence proposes a general-

ized framework for navigation which becomes, fundamentally, "the creation and interpretation of an internal mental model" (Spence). Wickens is more specific about the spatial processes involved in navigating a three-dimensional space, but "leaves no place for an internalized model of the environment such as a cognitive map." Situation awareness or consciousness about virtual geography or environment is merely a "by-product of the navigation process," not an essential constituent of that process (Yang and Olson 3.1); (Wickens). Fundamental disagreement about the interpretive and perspectival nature of navigation contributes to confusion in the VR literature about the role of subjectivity in the design of virtual environments.

A primary point of contention involves the extent to which situation awareness or the generation of an internal mental model depends on geographical orientation and the stability of a virtual landscape. Yang and Olson cite four basic requirements for enabling collaborative navigation, defined as information-seeking or -using among a group of mutually aware subjects: a) each participant requires an independently-controlled view of the environment; b) participants need the ability to converge on a common location; c) collaborative work is enhanced by the ability to understand the perspectives of one's peers; and d) participants need to remember and recognize stable spatial features of the environment, or landmarks (Yang and Olson 3). Most of these requirements fundamentally assume that the shared environment is actually (objectively) the *same* environment for all users. In fact, the solution to the problem of multiple perspectives (and note that it is consistently figured as a problem rather than an opportunity) is to offer some means for each user of switching seamlessly from his own view to that of a partner. Yang and Olson suggest that "it is harmful to correlate views across sites in a way that requires real-time effortful mental operation such as mental rotation" to appreciate the points-of-view of one's peers" (Yang and Olson 5.2). Their best solution is to minimize "effortful mental operation" by animating the transitions between visual perspectives in the form of a camera pan from one participant's point of view to another's. The feasibility of this technique demonstrates the extent to which the shared virtual environment is in fact modeled as an objectively identical, populated space. It's only the geographical positions of participants that differ; their internal mental model is presumed to remain the same.

But is cooperative work in and navigation of a shared environment possible if that environment is *not* modeled as an identical space for all

users? What if my view of the world actually constitutes a different world from the one you inhabit? Can we still build the kind of "shared mental model" that is thought to underlie all collaboration in digital environments under these circumstances? Are there circumstances (like those at play in the Ivanhoe Game) in which "effortful mental operation" to negotiate our conflicts is desirable precisely *because* it reveals perspectival and cognitive differences? A shared virtual environment that acknowledges truly different subjective experiences and the degree to which these perspectives do not merely reflect but actually *constitute* the space of play would not only extend but also take full advantage of Benford's concept of the *populated information terrain*, or PIT (Benford and Snowdon). PITs, in which both users and information are explicitly embodied in the same space, are designed to "support people in working together within data as opposed to merely with data." The explicit embodiment of users in the virtual environment means that they are "not relegated to the status of external agents whose presence is merely implied as a side effect of their actions" (Snowdon and Jää-Aro, "A Subjective Virtual Environment for Collaborative Information Visualization" 2). This close relation between agency and embodiment is in keeping with our understanding of the constructive role of perspectival difference. The very character of the Ivanhoe project implies that it is subjectivity that makes embodiment meaningful, and a producer of meaning.

There are clear advantages to be gained by modeling a virtual environment differently to different users, or even by offering different perspectives on the same space to a single user. Some of these (including the desirability of perspectival experimentation) become most evident when we imagine a data set with no apparently "natural" representational convention, unlike a CAD model of an architectural site or a VR representation of an airplane's cockpit. For abstract data sets, the most advantageous representation may depend on user idiosyncrasies or the particular tasks being undertaken by individual members of a group. The sort of landmarking advocated by Yang and Olson is perfect for geographically- or architecturally-oriented spaces in which stable landscape features not only make navigation and agreement among collaborators easier, but may (when artfully designed) help to promote certain types of actions. (The addition of virtual seating in a MOO environment in order to increase the likelihood of conversational encounters is one such example.) But appropriate visualization strategies for an abstract database may differ radically from the landscape model. Dave Snowdon and Kai-Mikael Jää-Aro

rightly indicate that, although the underlying relations that constitute a database "may be fairly stable, their use is not – information is continually dynamically combined in new ways and the mappings from data to 3D space cannot be known beforehand" (Snowdon and Jää-Aro, "How Not to Be Objective" 1.3.3).

This is clearly the situation in Ivanhoe, as the actions of players in creating, calling forth, and classifying new components of the discourse field and in defining and redefining the relations among these components (the central interpretive task of the game) actually *constitute* the evolving and emergent abstract landscape of the discourse field. The work of Snowdon and Jää-Aro in supporting subjectivity within collaborative virtual environments provides an instructive example of the directions in which an Ivanhoe interface might go. Their extension of the PIT concept to allow subjective views of data and of other users addresses two central problems: the virtual environment must be "capable of displaying different representations of the same artefact to different users"; and (critical for the issue of collaboration) it must exploit "appropriate techniques for representing users to each other in the case where the users are experiencing the virtual environment in quite different ways" (Snowdon and Jää-Aro, "A Subjective Virtual Environment for Collaborative Information Visualization" 3). These techniques and capabilities are fostered by the introduction of *body-centered configuration and artifact-centered coordinates*.

Body-centered configuration is a technique that allows participants to configure individual preferences for the behavior and display of objects they encounter in a multi-user environment. This strategy differs from relaxed WYSIWIS approaches to customization in that the users' preferences are figured as properties of their virtual embodiments, through which they themselves are "represented" to the applications that continually inspect and evaluate them as they move through an environment. No "explicit intervention" is required on the part of the user in order to specify or arrange displays as he encounters applications resident in new parts of the virtual space (Snowdon and Jää-Aro, "How Not to Be Objective" 1.4.2). User embodiments carry with them a "subjectivity flag set" which essentially generates for them new, private copies of the artifacts with which they interact. Interpreted in one sense, this approach fits perfectly with the philosophical stance of the Ivanhoe Game: it is the embodied perspective that impinges on the modeled environment to change it actively through its very gaze. In another sense, however, it runs counter to the desire of the Ivanhoe interface to impress on users their own agency in

shaping visualizations by forcing them to make their calls on texts and spatializations perfectly explicit.

Artifact-centered coordinate systems, on the other hand, offer a less philosophically-loaded solution to a problem facing Ivanhoe's interface designers: how can we enable subjective views of a shared space so radically divergent that they in fact constitute different worlds, while still making possible intersubjective collaboration and an understanding of the convergence of these perspectives into a shared, N-dimensional universe? Snowdon and Jää-Aro suggest that such a virtual environment model the positions and orientations of users relative to the artifacts that populate the shared world, rather than to some absolute system of spatial coordinates. No common metric is supported; instead, each user will see his peers positioned appropriately in a landscape of his own construction. In simple terms, the task involved here is to compute a given user's awareness of a set of objects, determine which of these objects appear in the subjective world-view of his collaborator, and then place a representation (or "pseudobody") of the user in an appropriate position and gaze orientation relative to the configuration of objects that has entered the awareness of the collaborator. These computations are made using a variant of the Spatial Awareness Model introduced by Benford in 1995, in which, for each communications modality relevant to a collaborative virtual environment, an object lends itself to user awareness through its *focus* and *nimbus* (Benford, Bowers et al.). The focus of an object is a representation of its presence in virtual space, and an object's nimbus is a spatial calculation of the field of attention surrounding it. When one object's focus intersects the nimbus of another object (which may be a human user), the object enters a scope of awareness that makes interaction possible. The "Aether Extension" to Benford's Spatial Awareness Model usefully introduces time as an additional coordinate in the awareness calculation, allowing the number or frequency of interactions and encounters with objects to figure into a computation of awareness (Sandor, Bogdan and Bowers). This extension seems critical to an Ivanhoe Game imagined not only as a prolonged collaborative project in which users might, over time, allow their focus on specific objects to dissipate and reconstitute, but also as a contextualizing activity which frequently and creatively broaches the historical character of the documentary record.

Despite their arguments about the inherent subjectivity of relational databases on which abstract data visualization in collaborative virtual environments can be based, Snowdon and Jää-Aro still assume

some objective reality in terms of the properties of objects (Snowdon and Jää-Aro, "How Not to Be Objective" 1.3.4). It is true that display values in their body-centered model are contingent on and resident with the user's embodiment and not intrinsic to the objects that user encounters, but the fundamental classes and properties of objects underlying the display remain consistent despite the vagaries of perspective. In this way, an objective common reality for the shared virtual environment is reinforced, and perspectival display becomes mere smoke and mirrors. Can we not imagine the embodiment of more deeply embedded forms of subjectivity in Ivanhoe and other networked or multi-user systems, made possible by marrying interface advances to similar advances in the computational models that underlie them?

Jää-Aro and Snowdon acknowledge that subjectivity is not only relevant to user interface, but could also be useful in programming environments, for example to support group programming activities without code conflicts or to enable better management of capabilities or permissions intrinsic to a particular user (Snowdon and Jää-Aro, "How Not to Be Objective" 1.3.2). It is in this light that Harrison and Ossher advocate a relaxed emphasis on the object in object-oriented technology in order to enable, through the exploitation of subjectivity, the development of integrated suites of applications, each of which may have different needs from and understandings of a shared collection of objects: "subject-oriented programming" (Harrison and Ossher). In order to understand the applicability of this concept to the Ivanhoe Game or other humanities computing projects, for "integrated suites of applications" we should read "collaborative groups of users," each of which may formulate and express radically different and evolving ideas about a shared set of documents. The goals of subject-oriented programming articulated by software engineers are also applicable to the development of electronic archives and interfaces in this way:

> *Subject-Oriented Programming*: "It must be possible to develop applications separately and then compose them" (Harrison and Ossher 412).
>
> *Ivanhoe Game*: It must be possible for users to develop interpretations separately and then combine their expression with the collaborative project of a group.

SO: "The separately developed applications should not need to be explicitly dependent on the other applications they are to be composed with" (Harrison and Ossher 412).

Ivanhoe: User interpretations should be able to evolve as independently of the common terminology and constraints of the established system as possible.

SO: "The composed applications might cooperate loosely or closely, and might be tightly bound for frequent, fast interaction, or be widely distributed" (Harrison and Ossher 412-13).

Ivanhoe: Close user collaboration (either with or without sharing of terminologies and typologies) should be enabled, just as private spaces and display functions are maintained.

SO: "It must be possible to introduce a new application into a composition without requiring modification of the other applications, and without invalidating persistent objects already created by them... Unanticipated new applications, including new applications that serve to extend existing applications in unanticipated ways, must be supported" (Harrison and Ossher 413).

Ivanhoe: New players, player roles, interpretive shifts, and user-created documents should be able to be introduced at any time during play, without invalidating preexisting perspectives and documents. We must accept as a condition of development that the interpretive and creative uses to which Ivanhoe software will be put are by definition unpredictable.

From the subject-oriented programming perspective, meeting these conditions requires that "no special status [be] accorded to the intrinsic properties" of objects (Harrison and Ossher 414). In other words, subjects (or the users or applications that embody subjective attitudes toward common

artifacts) need only share knowledge about a given object's identity. They can separately define and operate on the object set they share, without fully understanding other subjects' object definitions and certainly without keeping their own definitions uniform over time. This means that there is no longer a "state of the object" that is in some sense true or objective. An object is no longer defined as the union of its properties and behavior, which instead reside with the interpreting subject that invokes an object-identifier. Once subjects acknowledge the existence or non-existence of an object and associate a rudimentary identifier or name with the object, they are free to extend and develop their own interpretations and perform actions or invocations without disrupting those of others.

But how, given such a separate peace, might users collaborate in or share a common view of a document or discourse field? A primary challenge to the Ivanhoe development team (evident even long before the game was played in a software environment) has been to combat the solitude or solipsism inherent in the scholarly endeavor. Humanities scholars, much more so than architects, social scientists, or engineers, are unaccustomed to working in teams and find it difficult to integrate their private interpretations, traditionally expressed (appropriately) in monographs, with the evolving work of a peer group. True, we attend conferences and contribute to special-topic journal issues such as this one, but how often do we consciously and deliberately combine our perspectives on a text and produce joint interpretative work with a potentially fluid physical instantiation? In this way, Ivanhoe has more in common with the pedagogical experience and with experiments in dialogue as literary criticism (viz. McGann and Rockwell) than with the print-based structures and institutional methodology validated by the academy. Still, this connection with team-based work, the value of which is demonstrated by current humanities-computing practices, and our conviction that the traditional tools of pedagogy can be usefully applied to the work of serious scholarship drives us to develop an Ivanhoe Game which negotiates a rich middle-ground between contemplative isolation and cooperative creation.

To a great degree, just as in subject-oriented programming and collaborative virtual reality, this middle ground locates itself at the interface. We can understand interface as a point of interaction, whether between an application and the larger system, a user and the data underlying a particular visual manifestation, or among multiple users and the programs and displays they employ jointly and separately. In its most simple form, any shared, subjective interface is a "point of agreement between separate sub-

jects as to the operations that are available" on an object – or more properly, on its identifier (Harrison and Ossher 415). The concept of agreement (which implies and enables interaction and intersubjectivity) is crucial. In essence, the classical model underlying object-oriented systems is a view of objects as seen by a single subject. This model would remain adequate if all subjects operated in isolation from one another; however, if we wish to enable interaction and collaboration, multiple subjectivities must be supported in a common virtual space.

Multiple subjects are able to interact in a shared field (or to be "composed with one another in a universe") because of that field's artfully-designed composition rule, an algorithm which amounts to an "abstract specification of the semantics of inter-subject interactions" (Harrison and Ossher 415, 23). These guidelines and constraints have little to do with the individual subjective assessments of objects that users will make and remake throughout their work in the discourse field. Instead, they come into play when a particular operation is invoked that might provoke other users to change their interpretations about objects or to perform certain operations themselves. This, of course, is the whole point of Ivanhoe as a collective interpretive experience, and such operations must be enabled in our game. Appreciating the need for flexibility that any system acknowledging subjectivity must support, Harrison and Ossher specify that, "within a subject-oriented model, there [be] freedom to craft and use different composition rules" (Harrison and Ossher 415). Chandler Sansing, a secondary-school teacher involved in the early (pre-software) testing of the Ivanhoe Game concept, concurs. He strongly advocates development of an Ivanhoe prototype that permits the instructors who may initiate games to specify the composition rules applicable to their own content and curriculum. In this way, he suggests that Ivanhoe would be a superior tool to most educational software applications, which present students with fixed content or, at best, a fixed set of rules and constraints which may not remain relevant to their evolving understanding of a discipline (see Sansing's contribution to this collection).

I have suggested elsewhere that the Ivanhoe Game has strong natural ties to Peter Suber's thought experiment (since become a playable game itself), Nomic (Nowviskie, *Ivanhoe and Game Design*). The concept and preliminary set of constraints for Nomic, which Suber terms "a game of self-amendment," first appeared in Douglas Hofstadter's column in *Scientific American* in 1982. There, Suber addressed a central paradox in the American legislative system, in which an amendment to a law can

be interpreted as applying to itself, and therefore cancel itself out or otherwise alter its own meaning (Suber).

Nomic is a game in which the design of the composition rule becomes a joint, intersubjective effort and is, in essence, the whole of the playable world. All participants begin with and share a very simple, rudimentary rule set. The rule set does nothing more than legislate, in the broadest strokes possible, the role of the rules in enforcing player interaction and the initial methods by which rules may be amended. Every so-called *move* made by a player is an amendment to the very rules of the game, which makes every participant both a player and a game designer. Even more, this game makes every player-action adhere to an existing algorithm (the prior rule set), while at the same time imagine and embody a resistance, and interpret the algorithmic consequences of any action. So Nomic is a game of pure constraint, the object of which is to think your way out of and into algorithms, algorithmically. Player moves are interpretive and active at the same time, both reflective and procedural in nature. The unstated goal of most games of Nomic is never to end, to play a continual game, delighting in the emergence of global strategies and local patterns, in the expansion of the interpretive horizon, in the relation of the parts to the whole, and (above all) in your own inventiveness in building and living in the system.

Ivanhoe's development process, in which an evolving SpecLab team generates an evolving software specification and game model, bears many similarities to a prolonged session of Nomic. The mechanisms that may eventually support the implementation of those customizable rulesets Sansing suggests could, too, function like Nomic in bringing multiple perspectives and agendas in line with a single, overarching system of constraint. Shane Liesegang, a cognitive science student at the University of Virginia, is currently engaged with the Ivanhoe team in an independent thesis project to develop a Nomic server, which (despite Suber's own warnings about the difficulty of computer implementation of his thought experiment) seeks to record and in a limited sense enforce the composition rules and amendments which constitute both the playing field and procedural imperative of Nomic.

Development of an adequate composition rule (or set of interchangeable rules) to support either a subject-oriented technology or an abstract collaborative game involves a series of points of agreement among multiple subjectivities. The first of these, especially critical to Ivanhoe or other electronic archives that wish to facilitate user contributions, involves

object creation. Other points of agreement must converge around the nature of operations and the very nature of objects themselves.

Object creation begins when one user produces a new object (in the case of Ivanhoe, this is likely to be a piece of text) and classifies it according to his own perspective (perhaps as a letter alleged to have been written by the author of the novel at hand, commenting on a particular episode in the work). In an object-oriented context, the new object would thenceforth *be* a letter written by the author, commenting on that passage, and all users of the object would obviously treat it as such. The various invocations they might make of the object would necessarily depend on that identity, because no other invocations would be possible, given the fixity of the object's properties and behaviors. The subject-oriented and hermeneutical nature of the Ivanhoe Game, however, specifies that users be able to treat that very object in ways different from and perhaps contradictory to those suggested by the object's creator. In other words, a second user might wish to suggest that the letter be read as a chapter in the novel, rather than as an external comment on it.

The brand of subject-oriented programming advocated by Harrison and Ossher nicely enables this approach to object creation and modification. Two options for the integration of newly-created objects are presented. In the first, which has the advantage of conceptual simplicity, all subjects or users are required immediately to acknowledge and initialize a new object, understanding its creator's interpretation but ultimately classifying it according to their own perspectives. Since, however, understanding in collaborative contexts rarely proceeds in such an orderly fashion, the second option seems as preferable for Ivanhoe as it is for distributed computing systems. In the "deferred initialization" model, a new object appears as an uninterpreted, blank slate to all users except for its creator. Only as the other users or subjects have need of the object, either because they have invoked its inclusion in a visualization or because they wish to manipulate it in some other way, are they asked to accept (albeit tentatively) its creator's interpretation or formulate their own, new classification. Deferred initialization has performance advantages in terms of both time and space requirements, but even more importantly, it "facilitates graceful introduction of new subjects that extend existing objects" – something that Ivanhoe's emphasis on multiple, evolving subjectivities makes a necessity (Harrison and Ossher 417).

Further points of agreement touch on the nature of the operations or invocations available to users, and enable cooperative work with

objects in spite of (or perhaps *through*) the varying interpretive slants given them. Clearly – as any Ivanhoe session or committee meeting must indicate – "two arbitrary subjects cannot necessarily be composed with any expectation that they will cooperate effectively" (Harrison and Ossher 417). Limited agreement on the operations available to be called and their meaning (that is, on the actions permitted in the game space and the general results of a given action), contributes greatly toward cooperation among diverse subjects. I must be reasonably sure that my command to delete a line of poetry will function in the same way as yours in order to trust my own actions and comprehend the actions I witness. This certainty is called interface matching. Interface matching does not mean that users must share an identical workspace or that personal preferences and subjective views cannot be taken into account as actions are executed. It merely requires that some acceptable level of congruence exist in the commands available to different members of a collaborative group.

Class matching, the mechanism by which appropriate correspondences are developed among different users' *interpretations* of objects, is more involved. Harrison and Ossher hold that the simpler strategies for class matching dictate too great an emphasis on object and subject identity, as they require broad and centralized agreement on a set of interfaces and object-classes for the entire suite of cooperating subjects (Harrison and Ossher 417). Subjects (more particularly for Ivanhoe, the critical perspectives users may wish to develop) then must be composed with that set of global definitions as constraining parameters. The very presence of multiple subjectivities, however constrained, makes this mode more suited to the needs of humanities computing than many object-oriented systems. However, the more flexible the matrix through which multiple users are able to match their own classification schemes with those of their peers, the greater the potential for highly diverse subjectivities to be formed and gain expression in a shared space.

One promising option for this brand of flexible matching is largely action-oriented and may be well suited to the style of interface we imagine building for the Ivanhoe Game. According to this method, when one subject manipulates an object that another subject has (through deferred initialization) not yet defined at all, the second subject may base his classification of the object on what he observes his collaborator *doing* with it. This may take the form of *explicit class matching*, in which I classify the object based on my (perhaps limited or colored) understanding of your classification scheme and the object's place in it. Alternately (or in con-

cert), I may apply *interface-based class matching*, in which I make close observation of the operations you perform on the object and base my classification on them, assuming that your use of these operations, while not necessarily identical to mine, implies a system that can be mapped onto my own (Harrison and Ossher 417-20). In this way, points of agreement develop that are interface- and observation-dependent, individualized, and yet collaborative. Philosophically, this method supports the idea that the reality of the game (or discourse field, or software system, or object of academic study) is a shared construct, and that one user's interpretations depend less on the intrinsic properties of a given object than on his subjective observation of it and of other users' actions and interpretations relevant to it. Performative understanding of the type supported here is a central tenet of the philosophies of textuality and interpretation that give rise to Ivanhoe.

Subject-oriented class matching techniques of this sort verge on the problem (or perhaps the undeniable reality) of overlapping hierarchies which plagues text encoding and markup in the context of humanities computing. With the continued development of text archives that attempt to encode creative or poetic (rather than informational) material, the inadequacy of simple, hierarchical markup methods like those articulated by the Oxford Text Encoding Initiative (TEI) becomes evident. The difficulty generally does not come in marking up sentences, paragraphs, chapters, and other units that seem to express a natural hierarchy of organization – except, for instance, in those cases where a scheme for denoting page breaks may conflict with a separate scheme for marking poetic stanzas which, in a few cases, vexingly extend from the bottom of one page to the top of the next. More often, the problem manifests itself when you want to do something more patently interpretive with your markup, to express deliberately those out-of-sync creative structures which co-exist happily in the mind but less happily when parsed against an SGML document type definition. In other words, conventional markup systems share with conventional object-oriented systems the fetters of a single, constraining hierarchy. For text markup, this hierarchy is generally informational and organizational. In object-oriented systems, the hierarchy appears as a global, inherited definition of objects and their classes. In both cases, a subject-oriented approach shows great potential in "removing the restriction of having a shared definition of the inheritance [or nesting] hierarchy" (Harrison and Ossher 426).

Just as a subject-oriented approach to electronic text interface and

encoding could permit different markup and display schemes to be applied (perhaps even concurrently) to the same document, subject-oriented systems for collaborative computing allow multiple users or subjectivities to express themselves against a shared body of objects, without damaging the interpretations of others or altering irrevocably the objects on which they act. In fact, the subjective orientation places a premium on allowing these interpretations to talk to each other in the evolving formal languages their creators articulate. The divergent, overlapping hierarchies of classification such collaborative work necessarily engenders are (in an ideal implementation) supported exactly to the degree their users desire, as points of agreement emerge based on the performative actions of the group.

These points of agreement represent a much deeper intersubjectivity than that provided by access to multiple optical perspectives (based on height or proximity, for example) in virtual reality environments. In a proposed alternative to subject-oriented approaches to programming, Shilling and Sweeney offer a similar "object-oriented paradigm exploiting views, in which an object is seen through a multiplicity of interfaces to the object. Each interface determines the visibility and sharing of operations and instance variables" (Shilling and Sweeney). In a shallow sense or for an application less conceptually tied to the notion of free interpretation than Ivanhoe, such an illusion of subjectivity might suffice. But "true subjectivity," in the sense that multiple perceptions constitute rather than give access to the world, even (or especially) when they function in conflict, would remain elusive in a system like this. The subject-oriented approach, on the other hand, "emphasizes the ability of different subjects to form different behavioral hierarchies over objects, rather than consolidating them within a single class hierarchy" (Harrison and Ossher 426). As Ivanhoe is meant to be a performative environment for the interpretive actions of multiple subjectivities, different behavioral and classificatory hierarchies must exist in concert, just as they define, for Ivanhoe's players, the textual and documentary world that (always almost) exists.

From this review of general strategies for implementing subjectivity in digital environments, I turn now to a discussion of specific designs and concepts for the Ivanhoe Game. Although these designs – centering as they do around the interface – take visual form and draw in some cases on existing practices and technologies, they embody an understanding of visualization that differs from most humanities computing projects. Visualizations in humanities computing are typically positioned as end-products, static and algorithmically (seemingly automatically) generated

artifacts representing a culmination of the interpretive processes that went into the development of a digital collection. A prime example of this is "Rossetti Spaghetti," a visual expression of links among files in the Dante Gabriel Rossetti Hypermedia Archive at the University of Virginia (Figure 1). Rossetti Spaghetti was generated using simple GraphVis algorithms, similar to those Andrea Laue employs in her Ivanhoe-related work, and it astounds even the Archive's creators with its complexity and utility in making visible the carefully-specified yet often-obscured relationships among documents, images, and scholarly commentary in their established data structure. The image bears analysis and yields insights into the assumptions and interpretive acts that fueled the Rossetti Archive's creation. It comes, however, too late in the Rossetti development process to impact significantly the critical and interpretive work of archive-building. The content modeling phase, in which document types were defined and relational possibilities among them were opened up, is over. At best, Rossetti Spaghetti can lend us a new perspective on what already exists within the Archive, and serve as aesthetic provocation to new interpretations, which can be manifested *outside* of the Archive, in the form of essays, conversations, or even further visualizations.

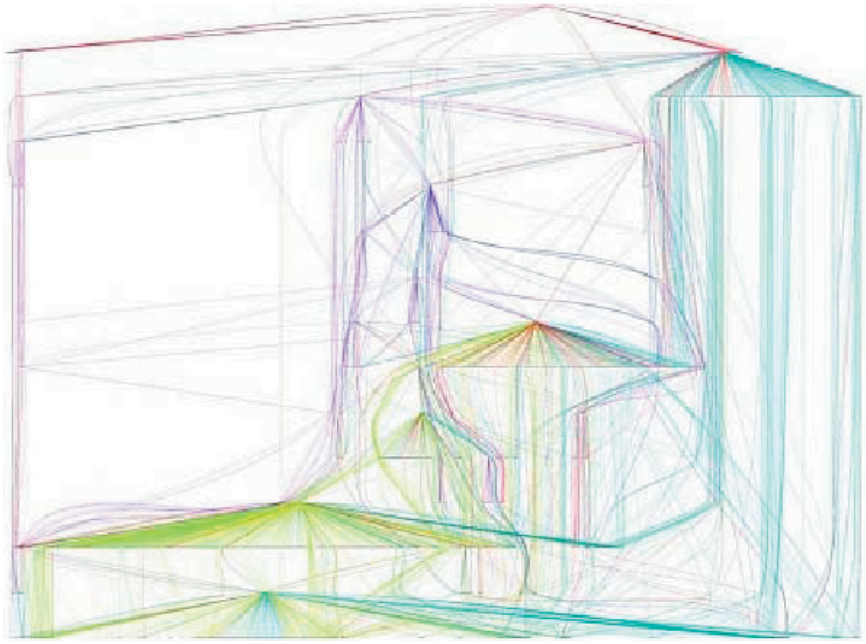

Figure 1. Rossetti Spaghetti

Visualization in Ivanhoe is meant to be part of an ongoing and environmentally internalized *process* of scholarship, not a snapshot of its progress or one of its external products. That is to say, every visual expression of a data structure in the Ivanhoe Game opens itself not only to interpretation by players, but also to active intervention within the very contexts in which it resides and evolves. We may still characterize these visual expressions as "aesthetic provocation," but in this case they provoke and permit interpretive responses that feed immediately into the computational matrix from which they emerge. In Ivanhoe, display is not merely generated, but also generative – of new interpretations, new data structures, new visualizations that are resident within the gamespace.

The Ivanhoe interface is being developed in the wake of another SpecLab project with a similar outlook on the role of the computer in enabling interpretation: Temporal Modeling. Temporal Modeling takes a less technologically-sophisticated but more direct approach to the involvement of visualization in content modeling, by translating user-created graphical diagrams and time-line sketches into a generalizable XML schema for temporal relations. This XML expression is a formalization of the intuitive, experimental, and even ludic brand of sketching the project enables in a paintbox-like "PlaySpace." Users may export this formalization to aid them in the development of content models for digitization and database building, or may elect to expand on their PlaySpace interpretions by working internally, in the project's graphical and text-based markup environments in tandem. No matter what the user's choice, the Temporal Modeling project demonstrates the degree to which visualization can become an integral part of a computer-aided interpretive process (Nowviskie, *Temporal Modelling: Update 2003*).

Similarly, Ivanhoe seeks to employ advanced techniques for data visualization within the context of ongoing textual and graphic activity. This activity both occurs in and constitutes a performative space, which maps the work of multiple subjectivities in dialogue with each other and with a collection of documents and objects. Furthermore, its embodiment opens itself to response by players in the very visual language in which the space itself is expressed, in order to emphasize the fluid and emergent qualities that visualization and interpretation hold in common.

Perhaps the most central of these commonalities is the shaping role of subjectivity. Despite their occasional opacity and an internal tendency in both to present themselves as having an a *priori* existence outside the vagaries of time and space, graphic visualization and scholarly

interpretation alike are produced through and contingent on perspective. Depending on the social and aesthetic trends at work in their composition, they resist or embrace perspectival understanding to greater or lesser degrees. Regardless, Ivanhoe wishes to demonstrate that the same manifestations of subjectivity evident in graphic forms can illuminate the subjectivity at work in interpretive acts, and that interpretation from explicit perspectives or roles is usefully manifested through visual techniques. I will now describe two general areas of the developing Ivanhoe interface that express and enable interpretive subjectivity and intersubjectivity in the context of the game, before turning once again to the wider problem in digital archive and text collection development of melding rich visual environments with rigorous computational structures.

These two areas of the Ivanhoe interface – the avatar system and the discourse field – involve twin challenges: how can we best represent the subjectively-understood textual activities of a single player or role? and how can we best represent the multiple points of view that, taken together, constitute a shared matrix of interpretive play?

The first challenge is, in part, addressed through Ivanhoe's novel approach to player avatars. Generally speaking, avatars are the embodiments of players or player-roles in games and virtual environments, and are usually thought of as "soul-less bodies for which the user acts as mind" (Sengers, Penny and Smith). We know them through non-digital manifestations (the top hat in a *Monopoly* game is a simple, tangible avatar) and through electronic manifestations (the voluptuous Lara Croft character of the *Tomb Raider* franchise is a much-discussed digital avatar) (Flanagan). An avatar typically functions as a placeholder or token that represents the position of the player in a virtual space. While it is grossly manipulable in the sense that it may be moved about or, particularly in role-playing games, clothed and equipped like a paper doll, the avatar is a fundamentally stable representation of the player – easily recognized, largely unchanging in form. Only recently has the game design community begun to question this stability. A yet-unreleased digital fantasy RPG (Big Blue Box's *Fable*) promises that a player's moral and physical actions throughout the course of the game will irrevocably alter the appearance of his avatar. Excessive sword-fighting, for instance, will result in the over-development of the avatar's arms, while an unhealthy interest in the occult will result in a pale and haunted aspect. Avatar appearance in turn will feed into the responses and actions of non-player characters in the game, provoking fear or admiration among a village's inhabitants in some cases, closing doors or open-

ing up plot-lines in others. The game's development code-name, *Project Ego*, suggests the importance of this feature in the minds of its creators and in the evolution of the digital role-playing genre (Molyneux, Carter and Carter).

Clearly, the Ivanhoe Game is meant to be a kind of "project ego," in which the force of player decisions, through the subjective lens of the role and the intersubjective lens of the interpretive community, colors and even shapes the world of play. Like *Fable*, Ivanhoe advances the concept of the avatar by making its physical manifestation both a product of and an instigator to player action in the context of the game, always figured as an embodiment of a self made real through activity in a social and artifactual universe. Our "evolving avatar system" therefore runs counter to the long-standing concept of the avatar as a stable representation of the player and as a mere token or placeholder in a virtual space. In fact, instability is the hallmark of this system, in which each player's avatar changes from move to move and serves as a dynamic map of his actions in the gamespace.

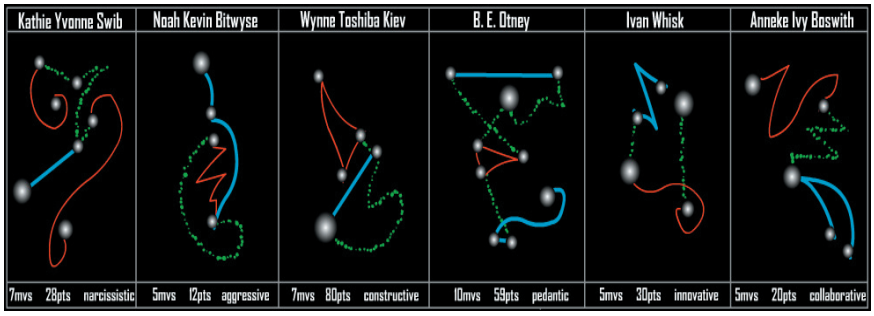

Figure 2. Evolving Avatars

In the design sketch shown here, silver nodes representing the player's textual contributions are joined by lines representing links or relationships expressed in the discourse field (Figure 2). The size of the nodes indicates the length of the textual contribution, while the colors and qualities of the lines correspond to a typology of linking moves either established by each player individually or agreed upon by the group. An animated sketch, available on the SpecLab website, shows how the form of an avatar morphs over time, depending on the actions of the player or role to which it is bound (Nowviskie, *Future Ivanhoe Visualizations: Evolving Avatar*). The metric and style of representation in play matter very little, and the exact specifications for the activities to be modeled are likewise adjustable,

so long as the avatars are made to depict gameplay consistently and in an aesthetically provocative way. (Of course, a style of avatar representation that matches other data visualizations in the game would best promote the sense of response-in-kind that I earlier posited as a goal of interaction in the Ivanhoe interface.)

Like Rossetti Spaghetti, an Ivanhoe avatar will emerge as a visualization of marked data, perhaps even taking form as a similar network of nodes and connections. This kind of information visualization differs from the Rossetti example, however, in two important ways. First, while it is meant to be publicly visible, an Ivanhoe avatar is personally-directed. Each avatar is to be understood by its player as a manifestation of selfhood and a reflection of personal behavior in a social space – an ego projection. The abstract, non-anthropomorphic form of the avatar helps to emphasize that avatars are not simple extensions of users or evidence of a user's wholesale transportation into virtual space. Instead, the Ivanhoe design participates in what Simon Penny has called a "semi-autonomous avatar paradigm," in which the avatar is not meant directly to represent the user, but rather to be seen as "the part of the system which is intimately connected to the user" (Penny, Smith and Sengers 22). Semi-autonomous avatars are revelatory, through unexpected behaviors or responsive physical manifestations, of the inner workings of the computational and social structures in which they reside. They partner with users and ask to be understood as separate but connected entities. Fundamentally, the Ivanhoe avatar intrudes into gameplay as an interpreted representation – interpreted by the system, by the player, and by the player's peers.

The close proximity, in our Ivanhoe interface sketches, of other players' avatars encourages comparison and reflection, leading to a greater understanding of the relevance of visualization to gameplay and embodied action. The design reproduced here goes so far as to propose addition of some subjective or qualitative *verbal* assessment of the style of play each avatar comes to represent, indicating gameplay that is "aggressive," for instance, or "charitable." These assessments could be generated algorithmically through analysis of the avatar's visual features, solicited from other players, or filtered from the prose evaluations of peer-moves the Ivanhoe Game requires. The addition of qualitative assessments in textual form to the graphic assessment that is the avatar is meant to emphasize players' ability to "read" the images that come to represent their roles and those of their co-interpreters. Like everything else in the gamespace, player avatars are meant to be interpreted subjectively and socially, no matter how seem-

ingly "objective" their mapping of player action may appear.

The other way in which Ivanhoe avatars differ from data visualizations like Rossetti Spaghetti involves their embedding in a dynamic space open to transformation with every user action. While, at any given moment in gameplay, the avatars *do* function like snapshots, showing a frozen view of the community's interpretive project, they are best understood as evolving or emergent reflections. While they do not enable the kind of direct action typical to most game avatars (running, jumping, shooting), Ivanhoe avatars participate more actively than most in the constitution of the gamespace by representing it to players and re-orienting it toward their subjective points of view or their roles. In this way, they are reminiscent of Michael Mateas' "subjective avatar" artwork, likewise meant to challenge the conventional notion of the avatar as a "passive puppet, providing unmediated agency within the virtual world" (Mateas, "Expressive Ai: A Hybrid Art and Science Practice"). Mateas' avatars are designed to emphasize the mediation of virtual experiences, by filtering "objective" environments and occurrences through an "autonomous personality model which reacts to events in the world and maintains an emotional state and narrative context relative to these events." The individualized state of the avatar becomes a lens through which the world is modeled, a "magic pair of glasses which allows the participant to inhabit an alien subjective position" (Mateas, "Expressive Ai: A Hybrid Art and Science Practice" 147). Mateas characterizes all of his work in the field he calls "expressive AI" as having more to do with artistic performance and cultural production than with traditional concerns of the artificial intelligence community, such as task competence and objective measurement (Mateas, "Expressive Ai: A Hybrid Art and Science Practice" 149). But the performance, in his model, is all on the part of the expressive AI artist, the programmer of the subjective avatar. Users who inhabit the avatar have some level of agency in navigating the virtual world, but they are fundamentally members of an audience, not performers themselves: "the avatar becomes an additional artistic resource for authorial expression" (Mateas, "Not Your Grandmother's Game: Ai-Based Art and Entertainment"). In contrast, Ivanhoe players are able to respond directly to information gleaned from their avatars and, in a desire to re-shape their physical manifestations in the gamespace, may engage in shaping that very space in ways which would not have otherwise occurred to them.

Through its emphasis on shaping and re-shaping, Ivanhoe's avatar design complements the work of Kristine Deray in modeling notational

avatars for collaborative work in information spaces. Deray confronts problems of analysis and display by embodying information in her avatars just as Ivanhoe does. She proposes an avatar design that represents gained knowledge about the contents and organization of a database in the "geometry and structure of the avatar visualized at the interface. In this manner, the design and form of the avatar functions as a content analysis tool representing interaction between users and an information space" (Deray). Different visible patterns in the avatars emerge based on rules interpreting user actions and interactions. These rules, however, apply to activities largely limited to searching and navigating a stable database, whereas Ivanhoe avatars map more creative and subjective interaction with an evolving space, centering around the creation of new material and the relationships that individual interpreters forge among documents and each other. Where Deray's avatars are outward-focused, indicating learned information about the location of material and the movement of peers in order to facilitate navigation, Ivanhoe's avatars demand introspection and become ultimately less about the shape of the gamespace than about the shape of the player's role.

Player avatars are one strategy for visualizing and even embodying subjectivity in the Ivanhoe game. The degree to which these avatars are best understood in juxtaposition with each other demonstrates the centrality of the concept of *intersubjectivity* to the wider Ivanhoe project. Ivanhoe is designed for collaborative gameplay and its interpretive products are those of a community of users. This brings us back to the second challenge outlined above: how can the Ivanhoe Game best represent multiple points of view constituting – like scholarship generally – a shared field of interpretive play?

We call the "populated information terrain" in which both Ivanhoe documents and users are embodied a *discourse field*. This term emphasizes the dialogic nature of action in the space, where texts and images become more than static research resources to be accessed in the aid of scholarship that happens elsewhere. Ivanhoe players, through their work in creating, interpreting, classifying, and linking bits of data, place documents in conversation as surely as they position their own roles within cooperative or competitive matrices. While the Ivanhoe Game itself exists as something of a hothouse, this conversation is meant to invoke a wider, wilder range of scholarship possible in the context of a rich documentary environment. Therefore the discourse field, as it is visually expressed, should imply extent beyond the objects (texts, sounds, and images, all centering around

the primary document in play) that have been defined and brought into the game by players. The field itself is meant to be understood as a realm of possibility, which could support any document a user might wish to call or create and which is capable of representing any constellation of objects, references, and links. This is not to say that the discourse field is completely nebulous, either conceptually or in its visual manifestation on the screen. The practice of algorithmic calling-forth which the Ivanhoe Game demands as part of bringing any piece of data into view demonstrates the procedural constraint inherent in all textual spaces, in archives as surely as in leaves and gatherings. Although the discourse field seems unbounded in scope, it is still constrained by our inherited procedures for defining and interpreting documents and works, and the expectations those procedures engender. Fostering awareness of the constraints we often unconsciously accept as a precondition of interpretation is a central goal of Ivanhoe.

A further mode of constraint at work in the discourse field is perspective. The interface (which in this case should be understood as more than the configuration of tools available to a user, and instead as all the graphic structures through which data is presented and made accessible) is made as personalizable as possible. This means that the visual organization of the space is relative to each player's role, and players may construct arrays of documents and reposition discourse field elements in patterns most suitable to their own interpretive enterprises. These fluid and idiosyncratic organizational schemes would be, in a primary mode, visible to their creators' roles alone, despite the fact that the discourse field remains a shared space in which many roles are working and – because they are embodied within the information terrain – actually have presence. Snowdon's notion of artifact-based configuration (as outlined above) is one option for making this openness to individually-defined patterns of constraint possible, without precluding the active presence of other users within a personalized view (Snowdon and Jää-Aro, "A Subjective Virtual Environment for Collaborative Information Visualization"). In this way, the Ivanhoe Game could allow users to define their own dimensions for display, just as they define (or inherit) the "dementians" through which literary interpretation always occurs (McGann). The difference here is that these dementians are made explicit through action in a visual field, in which relational and transformative performance is necessarily defined along user-created axes. Perspective, so often thought of as an abstract quality at work in scholarship, is here made visible.

But just as our evolving avatars become most meaningful in com-

parison or dialogue with each other, so do the visually-manifested interpretive assumptions and hypotheses of individual players of the Ivanhoe Game. In the case of avatars, comparison is a simple matter so long as a shared set of parameters for display can be applied to the most basic activities of gameplay: move- and link-making. But if the discourse field really enables multiple *free and subjective* organizational schemes to be laid over a shared data set, how is it possible that these schemes be reconciled? How is it even possible that one player be made to appreciate the relation of his own scheme to that of another user?

We require visual and computational strategies, working in tandem, in order to address these problems. One tactic would be to adapt Yang's practice of transitioning shifts in point-of-view from one player to another via graphic animation (Yang and Olson). Imagine watching your careful configuration of discourse-field objects slowly morph into an unexpected shape, representing (and perhaps, in its motion, revealing) new interpretive hypotheses or assumptions as individual documents slide fluidly into different user-specified positions on the screen. It would be possible to run this perspectival morph once (even repeatedly), for careful comparison between two roles, or as a long sequence, showing the discourse field configurations in use by all players of the game. A temporal element, too, could be introduced, as players compare their own prior organizational schemes with current ones, or run a view-morphing animation that accounts for multiple subjectivities over time. This perhaps jarring shift in subjectivity might even become a regular, provocative element of gameplay: a random occurrence, or a strategy to be employed by players eager to understand the hidden connections between their own work and that of their co-interpreters.

Another possibility involves treating user-defined interpretive dimensions/dementians in the same way that subject-oriented programming handles class matching among users with radically different notions of object classes and properties (Harrison and Ossher 417ff.). Would it be possible to use class matching techniques to synchronize in tolerable ways the visual dimensions either defined by users explicitly as they organize their views of the discourse field or which emerge implicitly from similarities in their patterns of action? In other words, could the similarities between individual interpretive views that are a necessary component of computational comparison arise, as in *interface-based class matching*, as a result of observation – either on the part of the machine or of Ivanhoe's users – of the practices of gameplay? Or could users be asked to define and

compare their own interpretive strategies against those of their peers, as they see both of them manifested within a similar visual matrix and constraining ruleset? In this case, the tactics required by *explicit class matching* could become part of the consciousness-raising project of the Ivanhoe Game, in which all the processes of gameplay (calling documents, arranging views, articulating roles, etc.) contribute to making players aware of their own agency as interpreters. Either scenario would permit the use of transparent overlays of individual views, carefully coordinated to share axes of interpretation, in order to construct a communal view representing the hermeneutic project of the entire playing community.

The construction of such overlaid views of the discourse field makes it possible for the Ivanhoe Game to offer as clear a visual expression of communal work as it does of the *inner standing point* of an individual player. The graphic manifestation of an inner standing point, or a subjective origin of both interpretation and display, is an important contribution of Ivanhoe's sister-project, Temporal Modeling, to visualization in the humanities. The notion is relevant here, too. In Temporal Modeling, users define an inner standing point for each timeline they construct as an interpretive hypothesis about human perception of history. Using a specially-designed tool, the nowslider, they position that standing point (perhaps understood as one person's or group's perspective on a series of events) at different intervals along the line, using its motion to reveal an evolving subjectivity. That is, they explicitly define a subjective view and configure a visualization around it and its perspective (Nowviskie, "Temporal Modelling: Visualizing Temporal Relations for Humanities Scholarship (Part Two: Composition Tool Design)"). In contrast, the Ivanhoe Game allows each user to define his own inner standing point implicitly as his role is articulated through textual activity in the course of cooperative play. Jointly, all these individual perspectives converge in contributing to a shared interpretive stance vis-a-vis the central document at hand and its procedurally-specified discourse field. This shared stance will change from game to game (even from moment to moment), constituting an important, visually manifested record of one community's engagement with a scholarly problem. Saved records make it possible to compare these defined dementians across several games using the same core text or shared genre, focus, or interpretive task, in order to reveal embedded assumptions that emerge when different groups approach similar issues. Likewise, an individual user could compare his own responses (mediated through a role common to several games) to a variety of texts and interpretive situations.

This makes the navigable dimensional display of the Ivanhoe discourse field as reflective on a large scale as evolving player avatars are on a small scale.

I return now to a question with which I opened this essay: "What visual cues might players need in order to engage with the Ivanhoe Game in a manner appropriate to its own theoretical stance regarding the social and autopoietic instantiation of creative works?" This work – partly speculative and partly based on our own prototypes and research in interface and database design – has addressed those aspects of that central theoretical stance related to subjectivity and intersubjectivity. The idea has been to organize both the computational structure of the game (for example, through a judicious use of subject-oriented programming) and the game's visual structure, through features like evolving avatars and comparative discourse field displays, in such a manner as to emphasize that Ivanhoe hinges on the free play of interpretation even within environments that normally seem fixed and objective, like a digital archive or algorithmically-generated data display. Furthermore, these proposed designs assume that interpretation is always of subjective origin, and demonstrate that such subjectivity can take visual, iterative, emergent form, feeding back into the computational matrix from which it has been coaxed. The ludic attitude of the Ivanhoe Game toward documents and subjectivities (or "players") in juxtaposition is not as far-removed from the conventional scholarly arena as it might appear. Ivanhoe is, at least, a thought experiment in the application of gamelike and intersubjective features to digital archives and collaborative work. At its best, we can see Ivanhoe as revelatory of the inherent nature of networked scholarship. The Ivanhoe Game suggests that *subjective interpretation, not objective access, is always-already the primary activity of a user of a digital resource.*

Imagine, then, applying Ivanhoe's interface-design strategies to existing, hierarchically-organized digital collections such as the Blake or Rossetti Archives. What role might there be among them for a strong subjective emphasis and our brand of openness to interpretation as an integral part of the *constitution* of a digital resource? That is, how might the structures that support these archives, and the methods that display them on a screen, be opened up to users in such a way that every encounter with a resource becomes *transformative* and *constructive,* rather than *informative* and – despite the early rhetoric of interactivity surrounding hypermedia – fundamentally passive?

My ongoing work in designing and now redesigning the interface to

the Rossetti Archive addresses these issues. In brief, I see a subjective and intersubjective approach as critical to making the case that digital resources (like bibliographical resources generally) should be understood differently by the academy. We need to show that these objects and collections open themselves up to interpretive scholarship in their very assembly and structure, and that they can be made more fluid and responsive to the activities of scholarship – that work within them can be less like navigating an archive and more like *building* an archive, less like using a scholarly edition than like constructing one. This fundamental and explicit shift in the role of users of digital resources – toward the performative, reflective, subjective, and constructive activities that characterize scholarship generally – should be relatively simple to bring about and highly salutary to our field. The relevance of visualization and text technology to the humanities at large may depend on our ability to bring emergent intersubjectivity into play.

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