Rochester Institute of Technology

A Thesis submitted to the Faculty of
the College of Imaging Arts and Sciences
in candidacy for the degree of
Master of Fine Arts

Physical-Virtual Workspaces

by Samuel Breneman

2.25.08

Graduate Industrial Design 2.25.08
Rochester Institute of Technology
Samuel Breneman
RIT - GRAD ID
Graduate Thesis Documentation
Physical-Virtual Workspaces

Thesis Approval

Chief Advisor:
David Morgan
RIT Industrial Design - Graduate Coordinator, Assistant Professor

_____
Date: _____

Associate Advisor:
Alan Reddig
RIT Industrial Design - Lecturer

_____
Date: _____

Associate Advisor:
Adam Smith
RIT New Media - Assistant Professor

_____
Date: _____

School of Design Chairperson:
Patti Lachance
Administrative Chair, Associate Professor, School of Design

_____
Date: _____

I, Samuel Breneman, prefer to be contacted each time a request for production is made. I can be reached at the following address:

Samuel Breneman
268 Alexander Street #29
Rochester, NY 14607
585.256.2209
soybase@aol.com
www.zer0.cc

_____
Date: 2.25.08

Table of Contents

Abstract

Connecting Physical and Virtual mediums

From a product design standpoint, we are encountering demands for solutions that exist between hard and soft mediums, and there is a need for workspaces that can support and connect both the physical and virtual development of such ideas. These hybrid products are bridging a gap between our physical and virtual experiences and creating new challenges as well as new solutions. In essence, they are serving to connect the tangible and the intangible aspects of our lives.

My thesis is focused on the connection between the physical and virtual mediums of information and experience. I hope to explore the workspace as a stage for composing such creative content that includes aspects which are both tangible and intangible. The design explorations will consider the balanced relationship of user experience and social interaction within the working space where intangible ideas are transformed into a tangible reality.

The goal is to develop a creative workspace that can be used to form and develop new ideas. The supportive stage would provide the space and means for accessing and manipulating both physical and virtual content, serving as an integrated interface allowing users the ability to fluidly express their ideas in both digital and material mediums.

Interfaces between Physical and Virtual mediums

As an example, technology represents a body of intangible knowledge that is applied in the physical world. This process transforms information into three dimensional representations which people can interact with. Most importantly, these objects have the ability to represent more than just knowledge alone. They have the potential to incorporate human concepts of thoughts, dreams, emotions, and memory that collectively reinforce the human experience. For these reasons, it is worthwhile to investigate the spatial form and visual representation of such ethereal aspects of information and experience to take the science of technology beyond the impersonal ‘black box’ of wires and circuitry. Such product solutions require the successful development of their applications and context sensitive scenarios as well as the form and packaging of their overall embodiment. As technology becomes an ever-increasing part of our lives, a growing challenge for humankind will be to preserve its essential role of expressing and acting out the very nature of what it means to be human in tandem with the developments of design. In order to sustain a prosperous quality of life, our progress in technology and design must preserve humanity by preserving the human experience.

To address such concerns, my thesis exploration will focus on investigating applications of technology that connect the physical and virtual experience through a tangible interface which encourages human interaction. The idea is to create a human-centered design rather than one focused on technology alone. With the growing level of connectedness within a networked world, there is an increasing need for the development of product solutions that aid humans in making and maintaining a more beneficial, productive, and enjoyable connectedness with each other and the

world around them. Such hybrid products of the future will be challenged to integrate both hard and soft mediums in connecting tangible and intangible forms of information and experience. This will involve the parallel development of product systems which include three-dimensional material structures with integrated interfaces to components of digital multimedia content.

The focus of this study views all technology, to some degree, as being purely tacit knowledge until it is applied through a physical manifestation or application. This process of transformation moves information from one medium to another and requires a fluid interface at the point of transition. Although transparent technology can be viewed as an appealing notion to avoid clutter and information overload within such a setting, there is an essential need for real, physical human interaction. An important question is: How can humanness be preserved within such a designed experience? One of the problems which emphasizes the lack of such qualities is evident in today's information workers who are 'losing touch' with the human intangibles of creative thought, dreams, emotions, memories, and sensations. To improve the design of such interfaces, we must ask, "How do objects or environments represent these ideas in a physical way to reinforce, confirm, acknowledge and draw us closer to our sense of what it means to be human?". These issues can be explored in the context of a creative workspace. This point of interaction and exchange is basically an information interface where ideas are transformed from one medium to another. The scenario describes a situation where a user needs to access and interact with intangible information in a tangible way. Several problems which arise include virtual isolation, information overload, and a general disconnected separation of the physical and non-physical worlds. Potential solutions could offer improvement through the evolution of tangible interfaces for intangible experiences. Such concepts would attempt to connect users with dynamic and transparent technology through an integrated physical interface. My proposal is to develop a creative workspace that connects the physical and virtual aspects of information and experience.

The proposed design will address the needs of middle-aged people interacting with each other, information, and technology. The creative workspace would act as an interface where information is transformed between physical and digital mediums. Such a design would be used in creative applications at any given moment when there is a need to access, transfer, or transform information. The setting of the design would be placed in an office, studio environment, or point of interaction and exchange for both private and group collaborations. Its purpose would be to support the need to connect to an intangible experience or access intangible information to be applied in a physical way. The design will attempt to create a hybrid, tactile-physical interface that combines aspects of both hard and soft mediums to assist in the organization and transformation of information.

The argument of this thesis suggests that the integration of both physical and virtual space within creative workspace environments serves to ultimately improve the meaningful connections between humans, their work, and their interactive experiences.

Introduction

It is now more apparent than ever, that we are fully immersed in an age of information and media rich experiences. Whether directly, or indirectly, humans today are developing extended relationships through mixed mediums of information and experience. These interactions are dynamically influenced through culture, the economy of business, media and communications within a more connected world. As our lives are becoming increasingly affected by such media-rich information experiences, it is becoming ever more critical to retain a connectedness to each other and the physical world around us in order to preserve deeper meaning and purpose.

The overall setting and spatial characteristics of these information based experiences are ultimately challenged to weave together both the tangible and intangible forms of an idea. These physical-virtual interfaces attempt to serve as both a stage and a portal where users can connect, communicate, explore, and compose new ideas allowing them to transform various types of raw data and information into a meaningful experience.

Connecting Physical and Virtual Mediums

From a product design standpoint, we are encountering demands for solutions that exist between hard and soft mediums, and there is a need for creative workspaces that can support and connect both the physical and virtual development of such ideas. These hybrid products are bridging a gap between our physical and virtual experiences and creating new challenges as well as new solutions. In essence, they are serving to connect the tangible and the intangible aspects of our lives.

My thesis is focused on the connections between the physical and virtual mediums of information and experience. The project is intended to explore the workspace as a stage for composing such creative content that includes aspects which are both tangible and intangible. The design explorations consider the balanced relationship of user experience and social interaction within the working space where intangible ideas are transformed into a tangible reality.

The goal is to develop a creative workspace that can be used to form and develop new ideas while enhancing the overall user experience and quality of human interactions. The supportive stage would provide the space and means for accessing and manipulating both physical and virtual content serving as an integrated information interface allowing users the ability to fluidly express their ideas in both digital and material mediums.

Issue:

There is a separation/disconnect between physical and virtual workspaces.

tangible - intangible

material - digital

Problems:

Transitions are difficult

-making connections/relationships is a challenge,

-managing virtual/digital/intangible information is a challenge

-people are losing touch with the physical aspects of their existence

---

Improvements:

Improve the point of Interaction/Interface,

-refine the transitions

-improve methods for interaction/manipulation

-improve the integration of tangible and intangible

Current Solutions:

Current solutions lack balanced integration...

-lack of support for both physical and digital

-poor/non-existent interfaces

-lack of flexibility in configuration/interface...(types of interaction)

Importance:

Creative work requires balanced integration of physical-digital mediums

Qualities of the workspace impact the overall quality of the human experience

---

Future:

Virtual-Digital-Intangible information and experiences will continue to increase into the future...

but the physical will not disappear...humans will be challenged to make and maintain a connectedness

between the physical and virtual aspects of their lives

Change for Future:

Propose to improve creative workspaces for physical-digital interactive work experiences

that support and enhance the quality of human interaction and creative development

Overview

Interfaces between Physical and Virtual mediums

A growing number of hybridized products today combine aspects which require the development of both the physical, tangible hardware and the virtual, intangible medium as well. Together these components form a multidimensional user experience which is defined by both physical-tangible and virtual-intangible characteristics.

As an example, technology represents a body of intangible knowledge that is applied in the physical world. This process transforms information into three dimensional representations which people can interact with. Most importantly, these objects have the ability to represent more than just knowledge alone. They have the potential to incorporate human concepts of thoughts, dreams, emotions, and memory that collectively express and reinforce the human experience. For these reasons, it is worthwhile to investigate the spatial form and visual representation of such ethereal aspects of information and experience to take the science of technology beyond the impersonal 'black box' of wires and circuitry. Such product solutions require the successful development of their applications and context sensitive scenarios as well as the form and packaging of their overall embodiment. As technology becomes an ever-increasing part of our lives, a growing challenge for humankind will be to preserve its essential role of expressing and acting out the very nature of what it means to be human in tandem with the developments of design. In order to sustain a prosperous quality of life, our progress in technology and design must preserve humanity by preserving the human experience.

To address such concerns, my thesis exploration focuses on investigating applications of technology that connect the physical and virtual experience through a tangible interface which encourages human interaction. The idea is to create a human-centered design rather than one focused on technology alone. With the growing level of connectedness within a networked world, there is an increasing need for the development of product solutions that aid humans in making and maintaining a more beneficial, productive, and enjoyable connectedness with each other and the world around them. Such hybrid products of the future will be challenged to integrate both hard and soft mediums in connecting tangible and intangible forms of information and experience. This will involve the parallel development of product systems which include three-dimensional material structures with integrated interfaces to components of digital multimedia content.

The focus of this study views all technology, to some degree, as being purely tacit knowledge until it is applied through a physical manifestation or application. This process of transformation moves information from one medium to another and requires a fluid interface at the point of transition. Although transparent technology can be viewed as an appealing notion to avoid clutter and information overload within such a setting, there is an essential need for real, physical human interaction. An important question is: How can humanness be preserved within such a designed experience?

One of the problems which emphasizes the lack of such qualities is evident in today's information workers who are 'losing touch' with the human intangibles of creative thought, dreams, emotions, memories, and sensations. To improve the design of such interfaces, we must ask, "How do objects or environments represent these ideas in a physical way to reinforce, confirm, acknowledge and draw us closer to our sense of what it means to be human?".

These issues can be explored in the context of a creative workspace. This point of interaction and exchange is basically an information interface where ideas are transformed from one medium to another. The scenario describes a situation where a user needs to access and interact with intangible information in a tangible way. Several problems which arise include virtual isolation, information overload, and a general disconnected separation of the physical and non-physical worlds. Potential solutions could offer improvement through the evolution of tangible interfaces for intangible experiences. Such concepts would attempt to connect users with dynamic and transparent technology through an integrated physical interface. My proposal is to develop a creative workspace that connects the physical and virtual aspects of information and experience.

The proposed design will address the needs of middle-aged people interacting with each other, information, and technology. The creative workspace would act as an interface where information is transformed between physical and digital mediums. Such a design would be used in creative applications at any given moment when there is a need to access, transfer, or transform information. The setting of the design would be placed in an office, studio environment, or point of interaction and exchange for both private and group collaborations. Its purpose would be to support the need to connect to an intangible experience or access intangible information to be applied in a physical way. The design will attempt to create a hybrid, tactile-physical interface that combines aspects of both hard and soft mediums to assist in the organization and transformation of information.

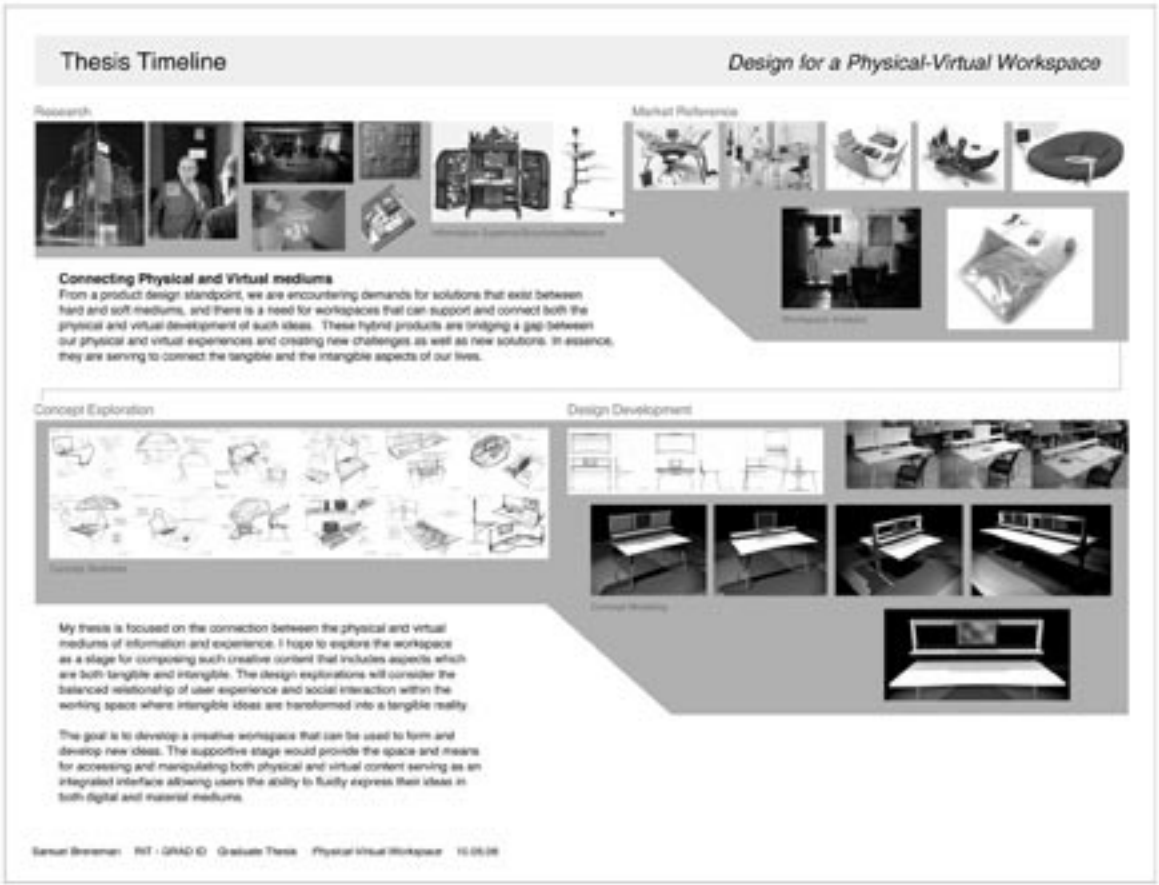


Table 1: Thesis timeline overview

Table 2: Research References

Connecting physical and virtual mediums of information and experience

Topics for exploration

Spatial characteristics:

- investigate the layering of technologies
- dynamic displays of information within a fluid/dynamic space
- the structure and organization of tangible and intangible information
- information that flows with human/user movement and task patterns
- the flow of information
- space that defines patterns of interaction and workflow
- creative spaces that structure thought
- physical/virtual planes of thought and information
- organizing processes...arranging of groups...creation of categories
- 'cognitive spaces' that reflect human thought/emotion
- physical thoughts
- patterns of thought and patterns of action...patterns translated into physical space
- structure of thought and structure of action...structure translated into physical space
- what does a hybrid physical-digital creative workspace look like and how does it behave?

Mediums of Information:

- how does the type of information we interact with determine the layout or affect the landscape of our creative workspaces?
- is there a difference between physical and non-physical symbols that correspond to intangible concepts?
- how do we store/organize information in both hard and soft mediums?
- physical manipulation vs. virtual manipulation
- transitions from the virtual medium to the physical medium
- transforming information between mediums of existence

User Preferences and Interaction:

- how do people define the subtleties of secluded isolation and personal privacy?
- what are the needs of individual users?
- what are the needs of collaborative groups?
- virtual interaction vs. physical interaction
- virtual connections vs. physical connections
- humans connected to technology vs. humans connected to humans through technology

Historical Context

From cave paintings and clay tablets to the technologies of our present day, there are countless indications that humans value the ability to express and record their ideas in order to share and communicate with others or simply to establish a lasting record of their thoughts and experiences. In some ways these lasting artifacts of human expression and experience can speak just as clearly as the messages they contain. Ultimately, the objects and their messages become intertwined as one lasting expression of human experience.

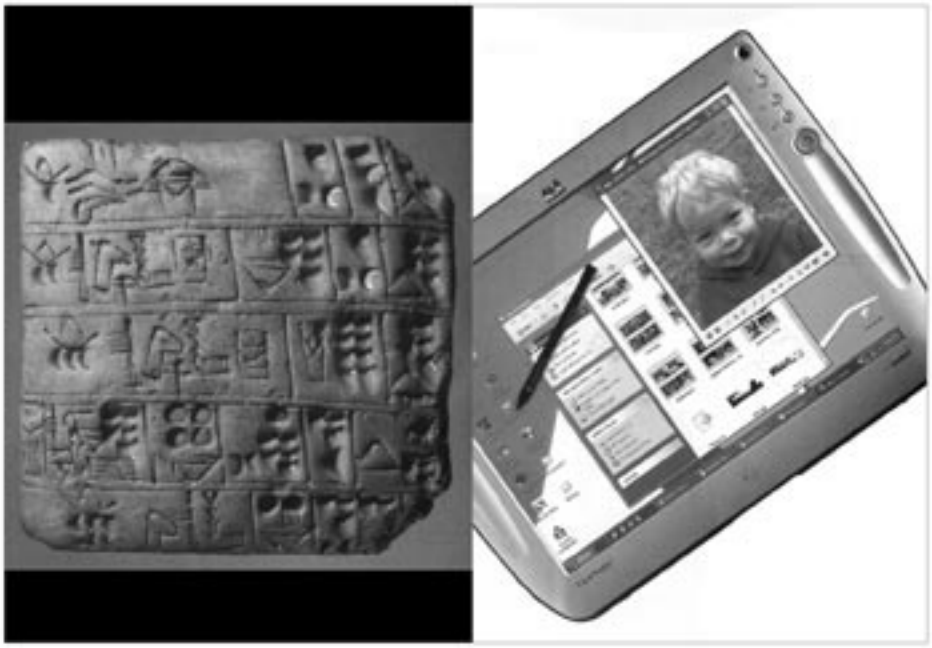


Table 3: Research References

As a an evolved civilization, we now have the ability to record and archive these experiences in so many new ways with the development of the digital medium and the advancements in networked computing. These evolving technological developments now provide near limitless means of recording and archiving the information of experience with fewer physical requirements like those often associated with traditional, physical storage mediums. Vast databanks of information can now be recorded with little concern for issues such as a lack of physical storage space. In addition, digital information and multimedia content can be archived, transported, transformed, duplicated, and retrieved with previously unimagined speed and ease.

However, with all of these considered benefits aside, there are still areas for consideration such as the growing concern for the very lack of physical substance to the increasingly digital artifacts of this new era in technology. One apparent difference is that physical forms of information such as printed books and other tangible media will retain a persistent level of readability over time that is independent of such requirements for special technologies like compatible hardware and software to process and view the digital media. This issue of preserving the ability to access and view the recorded information of our human experiences is intensified by the growing tendencies and seemingly increasing pace

of advancing technology to quickly become outdated as newer versions are developed. As an example of the ephemeral vulnerability of digital media, one could imagine a series of digital photos, scanned images, or text based documents stored and existing only on a single computer hard drive that for some reason or another becomes unreadable. Without any copy or record in a physical, tangible form, these bits of digital information could be irrecoverable. Although these types of problems are somewhat common, there are preventative measures to reduce the likelihood of such data being lost forever. Most importantly however, this example points out some of the weaknesses of the virtual intangible medium of digital information which must be considered in the overall development of any information system.

There are many who express concern in regard to the intangible and virtual qualities of digital information technologies. In the book *Technopoly*, Neil Postman warns that, “information is dangerous when it has no place to go, when there is no theory to which it applies, no pattern in which it fits, when there is no higher purpose that it serves.” Postman argues that “human skills and traditions are being lost by our immersion in a computer culture.”
(Postman 1992)
At present, these issues related to the digital medium of information and experience suggest that there is still a need for improving their physical integration within a connected physical-virtual information system. In essence, the intangible experience of the digital medium requires a physical embodiment or interface for direct human interaction. It is this interactive component which becomes one of the most valuable aspects of these new hybridized interfaces for physical and virtual experience.

Such technology that is intended to support humans in their ability to express themselves and communicate with each other must somehow be designed and optimized for the human users versus the inhuman technology intended to serve the users. This approach requires products that are built around the needs, patterns, habits, and personalities of their users’ actions.

There are many examples of sociological studies which look at the way people work and interact with each other in workplace settings. Much of this research has aided designers architects and office planners in developing appropriate spaces for the specific nature of their work and the dynamics of their organizations. From concepts of the *Action Office* to the *Office Landscape*, there have been many advancements toward improving the overall atmosphere of the common studio office workspace. These improvements, for the most part, make the work setting more enjoyable for the workers, promote more positive morale of the staff, and generally aid in increasing the overall efficiency and quality of the work being done. The idea is that with careful thought and planning, workspaces can be designed to optimize a conducive atmosphere which is better for the workers and also beneficial to the collective success of the company and society as a whole.

* *Action Office* of the 1960s by Robert Propst, for Herman Miller
* *The Office Landscape*...(Burolandschaft)...(Germany, Progressive Architecture, 1968)

In her book *Workspheres*, Paola Antonelli comments on the history of the evolving workspace environment and some of the major developments within the industry and society. She mentions that in the 1960s-1970s, "working environments tended to emphasize concepts of standardized systems which were reflected in the spaces and equipment in which they were performed'. Antonelli notes that the 1980s brought on the 'emergence of digital technologies with the development of systems that are so vast, flexible, and fast that they no longer appear to be systems." She states that "personal computers changed the way we conceive our daily tasks and organize our thoughts." Antonelli notes the many "changes in the workplace brought about by the rapid evolution of information technology" including "the placelessness of the cyberworld- as a principal definer of the nature of 'workspheres'."
(Antonelli 2001)

As the technology of the workplace continues to change, so must the workplace setting. For instance, today we must deal with the needs and requirements of both the physical mediums of paper-based media as well as the virtual mediums of digital data. This affects the way we handle, store, and ultimately interact with these various forms of information. Currently, people are adapting not only to new technologies within the workplace setting, but also to new ways of working. Advancements of the digital revolution such as distributed computing and wireless networks are changing the way people work and interact with each other. Work groups and styles have evolved to become more flexible in their ability to adjust and adapt to the type of activity or context related scenario of the work at hand creating a more dynamic and responsive nature within the workplace environment.

In some ways, the entire atmosphere of the workplace can be viewed as a living organism that is constantly in flux. Partitions move, tables and seating can be reconfigured, and peoples' interactions will change interactively with the surrounding space. Whether as a mazework of cubicle paths and neighborhood clusters or as an open office amorphous cell, the layout and structure of the workspace setting will have a direct impact on the interactions between the workers and the work being done. Ultimately, the office environment both reflects and supports the nature of the work, the types of staff interactions, and the attributes of the company as a whole. With this understanding, we can view the development of the workspace setting as a way to shape, support, and communicate the nature of the work and the types of human interactions we hope to achieve in the process.

Developing an Idea: The Exploration

The process of exploring and developing an idea is not easily defined. It may be different for each person and may change for each subject of focus. Such a process may best be described as generally more dynamic rather than static. One may describe their tendencies to be more linear or spatial or visual in nature, but this could vary greatly from person to person. Even for one individual or group, there may be times when the nature of their work can shift between different work flow patterns or modes. There may be times when the type of exploration is more linear, or amorphous and free form, or spatial, and so on. In a way, there may not be any one single method or fixed process for any individual to explore, express, and develop their thoughts and ideas for all possible applications. Likewise, there may not be any particular setting which could satisfy all the needs of an entire population of users in the process of evolving their creative developments.

With these basic assumptions, it may be reasonable to take an approach in developing a dynamic space that can at least attempt to offer an optimum amount of flexibility and variability within its capabilities and configuration so as to satisfy an acceptable range of working modes and styles within a general group of target users. These needs would likely vary between different types of workgroups, for example designers, architects, or students in an educational setting.

For many of the “knowledge workers” of today, however, they will all be challenged in some way to integrate both the physical and virtual attributes of their information based work. This involves making and maintaining connections between ideas that are represented in both tangible and intangible forms. As an example, paper documents often reference information contained in a digital file. Another idea may involve a physical model, a two-dimensional visual image, and a three-dimensional computer model. Such issues related to the form and medium of the information based media, will inevitably influence the way in which we are able to interact with and manipulate these raw materials used in the exploration and development of new ideas. For these reasons it is critical to develop a workspace interface that can serve a user in making and maintaining a fluid connection between the physical and non-physical mediums of information and experience. As information moves between tangible and intangible forms, this interface must adapt to the type of media interaction. The workspace in general must also be able to adapt to the context and actions of the user or group interactions. There may be instances for individual work in private solitude as well as the need for interactive group collaboration where cross feedback is required. The context of user interaction may call for a workspace to explore, to conceptualize and develop, or to communicate and present information to others. All of these variations must be considered in optimizing a creative workspace to support human interactions.

* ‘*Knowledge worker*, a term coined by Peter Drucker in 1959, is one who works primarily with information or one who develops and uses knowledge in the workplace.’
http://en.wikipedia.org/wiki/Knowledge_worker
(accessed 7.19.07)

This ability to draw meaningful connections and establish relationships between different points of referenced information represents a major component in the ideation process. In the book, *How To Think Like Leonardo DaVinci*, Michael Gelb describes DaVinci's amazing abilities as drawing from a sense of "Connessione" - "A recognition of an appreciation for the interconnectedness of all things and phenomena, or systems thinking." (Gelb 1998)

Postman writes that "information must be connected to or with human purpose." In his analysis of human interaction with 'information machinery', which he defines as technologies for managing information, Postman states that "the computer defines humans as information processors and nature itself as information to be processed." (Postman 1992)

As one might expect, the many differences in user work styles often require a certain amount of customization within a creative workspace. There are simply some users who prefer to do the majority of their thinking in physical space as well as those who prefer to work out their ideas in a more virtual setting. For example, one person may develop physical models of their ideas where another person may build virtual CAD models. And of course, there will be combinations of the two where it is important to be able to work in both mediums simultaneously within the same workspace environment.

*The following comments are taken from a user survey which asked potential users a variety of questions regarding their optimal workspace settings and preferences.

Xanthe

- in transforming ideas into a physical form: "I write a lot...using charts matrixes…columns…categories…circles and connections"
- to evolve and execute ideas: "I use blind explorations in 3D form"
- in using digital/physical tools: "I don't use them in the same place…but, pulling up an image would be useful"
- methods for organizing thoughts and ideas: "matrix…word list categorized…statements…libraries of images… #'d drafts…versions…process - (marked experience)"
- to access, view, and manipulate critical information: "burn cd's…hard media…post its…jot down on paper first - then computer"
- where do you do most of your work: "time of day is important(work best in early morning)…'big'…kinetic/kinesthetic …open space…"
- translate from virtual to physical: "print out for physical feel…'feel'…information becomes spatial…"
- transfer from physical into digital: "digital camera…desktop references…"
- is work in a localized environment or mobile: "home reading…relaxed, more focused…preferred environment depends on task"
- general environment or setting: "shelf all around…shelving/desk all around…work & display…"
- essential features: "computer - separate internet?…internet is/can be a distraction"
- improvements for physical-digital interface: "omit clutter…not so much 'multi-functional'…(more minimalized?)"

Yung Lin

- in transforming ideas into a physical form: “print, draw, hand writing, take pictures”
- to evolve and execute ideas: “depends on the project…work in 3D quickly…then print out…edit/modify… then transfer back into computer/digital”
- in using digital/physical tools: “digital camera…document & communicate…(big picture ideas)…document interaction - physical”
- methods for organizing thoughts and ideas: “could be both sketch on a paper or sitting in front of computer…prefer paper better (less constraint)”
- to access, view, and manipulate critical information: “desktop computer…pda…sketchbook…static image… pictures…text based info…”
- where do you do most of your work: “sketchbook 30%, computer 50%, …20% misc?”
- translate from virtual to physical: “by printing a technical drawing, rendering, or using prototype machine to make a physical representation”
- transfer from physical into digital: “half of the time I rethink the whole idea then input it into digital medium…some times using tools such as scanner, digital camera, …”
- is work in a localized environment or mobile: “work in localized environment…w/tangible and intangible information …more freedom on paper”
- general environment or setting: “big table + a desktop + papers + templates + markers…tools… open/closed (doesn’t matter)…music(headphones)…’clear space in front of me’ is important…worked a lot on a computer…started to work with more tools(for paper based work)…don’t want to sit at computer and do nothing...thinking more on paper...noteboard...pinup”
- essential features: “music!...easy access to whatever I need…a ‘working space’ - usually a clean platform to sketch or do whatever.”
- improvements for physical-digital interface: “a E-ink device for some temporary document…a handy scanner & printer…touch screen…tablet”

David

- in transforming ideas into a physical form: “so many ways...”
- to evolve and execute ideas: “sketches, 2 1/2 D models, 3D sketches”
- in using digital/physical tools: “I try to move between the two, but it is cumbersome”
- methods for organizing thoughts and ideas: “I use a scroll”
- to access, view, and manipulate critical information: ?
- where do you do most of your work: “shop, office, work table, colleague’s office”
- translate from virtual to physical: “full size drawings, templates”
- transfer from physical into digital: “keyboard, mouse, 2D scans, photos, modeling”
- is work in a localized environment or mobile: “mobile”
- general environment or setting: “no students interrupting”
- essential features: “work surface, paper tools at hand, peace”
- improvements for physical-digital interface: “physical into virtual is way underdeveloped”

If the creative workspace is to serve users as a platform or interface for the exploration and development of their ideas, it should offer both a conducive setting and structure to support the user’s creative process. These aspects of environment and spatial order pertain to both the physical and virtual information space. Such a creative workspace should carefully integrate both the tangible and intangible forms of information and experience for a fluid flow of ideas and information in the transformative process.

Settings and Environments for Ideation

So what is the optimal setting for a physical-virtual workspace? Can the diverse needs of a range of users be met within any one setting or space? How does the space and surrounding environment impact the users workflow, interactions, and overall experience?
The environment for ideation reaches into both the physical and non-physical realms as we evolve our ideas with various methods using both tangible and intangible means. The thinking tools of ideation may involve associative word lists, bubble diagrams, visual brainstorming, sketching, modeling, and so on. These are a few common methods that can be applied through both physical or virtual mediums, and depending on the need of the particular situation, one may be more suitable than the other.

If a creative workspace is to offer a conducive environment for exploration and ideation, it must be able to support a process that can take place in either a physical or a virtual space. In addition, it should be capable of serving a user or group to work with both tangible and intangible media either independently or simultaneously in a fluid and clear manner so as to preserve the connectedness of their thoughts and ideas throughout the process. The ability to connect, compare, and maintain essential relationships between multiple bodies of information allows users to add deeper meaning to what might otherwise be seemingly disparate data. These critical connections between separate mental images are like strings of thought woven together to form the overall fabric or our collective body of ideas.

This approach to ideation which references different forms and mediums of information would define the setting and environment of a creative workspace to include both the physical space and the virtual space as well. Together they form a hybridized ‘thinking space’ for users to explore and develop their ideas. The symbolic connections between the two mediums is where meaning must be reinforced and maintained for a smooth transitioning of coherent, unfettered thought. This can be quite a challenge when these meaningful connections are sometimes abstract or metaphorical in nature. This is where information interfaces can aid users to develop and preserve the critical links of their ideation process.

These points of transitioning thought can act as portals as well as filters where information can be explored, sorted, arranged, and linked to other related ideas in the process of ideation and development. Within any given setting or surrounding environment, there may even be multiple points and forms of such information interfaces allowing a range of different types of user interaction optimized for the contextual needs of both individual and group scenarios. Such settings could provide impromptu spaces for brief interaction and exchange or serve as a more long term dedicated space for an ongoing project. Distinct spaces within a connected environment could cater to distraction free privacy, or to more open collaborative exchange. Through the thoughtful planning of the spatial settings and their arrangement within a connected environment, the collective workspace can both direct and support the flow of information and human interaction in the ideation process.

In How To Think Like Leonardo DaVinci, Gelb describes DaVinci's awareness of "environments that encourage or shape behavior." Gelb describes these as "synaptic environments", or "responsive environments."
(Gelb 1998)

In their book, *The Art of Innovation*, Tom Kelly and Jonathan Littman describe the development of an optimum environment for innovative ideation as "building your greenhouse." In referencing the workplace as a greenhouse, they comment on "creating spaces as building blocks" as well as "evolving spaces that tell stories." Their approach basically identifies the creation of such spaces intended to "draw people in and encourage interaction" yet while also providing "comfortable blends of openness and privacy."
(Kelly and Littman 2001)

In his book entitled *Workspace*, Franklin Becker describes the impact of the workplace environment as a "catalyst" that can influence "behavior and activity patterns." Becker comments that such spaces and environments can serve to "stimulate types of social interaction and communication." Becker describes these settings as both "physical and social."
(Becker 1981)

These examples suggest that such settings and environments for ideation are in a way very much 'alive' and dynamically interactive with their human users.

Table 4: User Research

The Physical Space

Although the physical space may represent the most apparent attributes of a workspace setting, the difficulty lies in making these features tie in to the intangible aspects of the information systems and social interactions they are intended to support. Like an underlying structure or framework, this spatial environment can serve to establish a system for organizing and transforming information as well as encouraging certain types of activities. The physical space has a very direct impact on the type and flow of human interaction which it allows or promotes through the functions of its component elements and the architectural system of their arrangement.

The physical space within a workspace environment is not necessarily represented as a purely static structure. Such a spatial system may be more dynamic in the sense that it allows for users to reconfigure certain elements to suit their situational needs or preferences. Environments may be more or less organic in their ability to change, evolve, and adapt to the needs and activities of their human users. In fact, over a period of time, a workspace in use will inevitably reflect the signs of the types of user interactions and activities it encounters and supports. Whether intentionally or unintentionally designed from the start, a workspace will tend to evolve often with user modifications driven by the preferences and needs of human activity and interaction. Similar to the wearing in of an often used tool, a workspace will in effect be shaped by its human users. The more flexible the environment, the more quickly a group will be able to move in and adapt to using the space and resources of such a workspace setting.

In return, the physical space will both shape and support its users as well. The physical characteristics of a workspace can act to guide and direct the flow of information, activity, and interaction which will inevitably affect human behavior within the workspace environment. Spaces can be open or closed, separate or connected, public or private, and these aspects will inevitably affect the qualities of human interaction within such spaces. In addition, such spaces could include aesthetics that are very ordered and structured or very relaxed and organic. Such spaces could convey formal or informal types of behavior. All points of sensorial input within a workspace are capable of influencing the qualities of human interaction. Shape, form, color, textures, lighting, sounds, scents and air flow can all contribute to the overall user experience within a workspace environment. These ambient aesthetics of the physical space of a workplace can symbolically communicate messages, qualities, or values in both obvious and subtle ways.

Kelly and Littman mention “culture as embodied in physical space.” They describe “space that creates and reflects a work process as well as a sense of identity.” Many of their strategies of using space to support innovation make suggestions for the creation of “spaces that celebrate process and teamwork.”
(The Art of Innovation 2001)

Postman describes physical interactions as “human intelligence interacting with the environment.”
(Technopoly 1992)

These examples suggest a direct connection between human beings and their surrounding environment in that they can both influence and shape one another. With this understanding, the workspace environment can be optimized for the work as well as the workers. If the primary focus is to enhance the overall quality of the human experience, a creative workspace must serve to support the technical requirements of the work as well as the social requirements of the workers' activities.

To some degree, it is the physical space which assists users in transforming their ideas into a tangible form. This act of representing ideas in a physical way, creates opportunities to ground our thoughts and solidify our ideas in order to play and test out assumptions. When information takes on material form, humans are then able to share and interact with such ideas in a very direct and more intuitive way. The ideas and information become public where humans can physically interact with the conceptual forms and draw a direct relationship between the ideas and themselves. These transformations bring intangible ideas into a physical, tangible existence closer to associations of physical space and time that can add deeper meaning through context. For these reasons, physical space plays a critical role in the ideation process.

As physical space continues to evolve, it has been taking on new attributes that often reference complimentary virtual digital spaces. The physical world is now tracked, mapped, and referenced in virtual space in a way that has blurred the boundaries and formed a new interconnectedness between these two separate mediums of material and immaterial. In a way, the physical world has expanded to include aspects of this virtual space as well.

In response to these changes, creative workspaces today, must address the need to power our tools and technologies for accessing and transforming information but must also provide connections and networked interfaces for work and communication with others. These points of connectivity can represent points of interaction and activity where power and information flow between different forms and locations. Such ports of exchange symbolically represent the connection of our physical and digital worlds. In addition, they also serve as shared interfaces between users and their social interactions. For example, message boards allow individuals to use a shared space to present their ideas and communicate with one another. Three dimensional objects can be arranged on open shelves and public spaces to invite user interaction and feedback. Within the physical space of a given workplace setting, there may be multiple forms of such devices used for the exchange of information and ideas.

As a landscape of signs, symbols, and patterns, physical space is essential in that it provides the means for physical human interaction with tangible forms of information and experience. Through this setting, users are able to make direct references to real scales and proportions while being able to establish deeper meaning and understanding through hands on interaction. Tangible information systems within physical space allow users to both compose and develop their ideas in a spatial manner with real-world relevance tied to environmental and situational contexts of real physical human interaction.

Ultimately, the ongoing challenge is to develop the physical space with a balanced connection to its virtual counterpart without sacrificing any of the benefits and positive qualities inherent in the physical world. This involves providing for an immediacy of visual access, or quick scanning of virtual media within a physical environment.

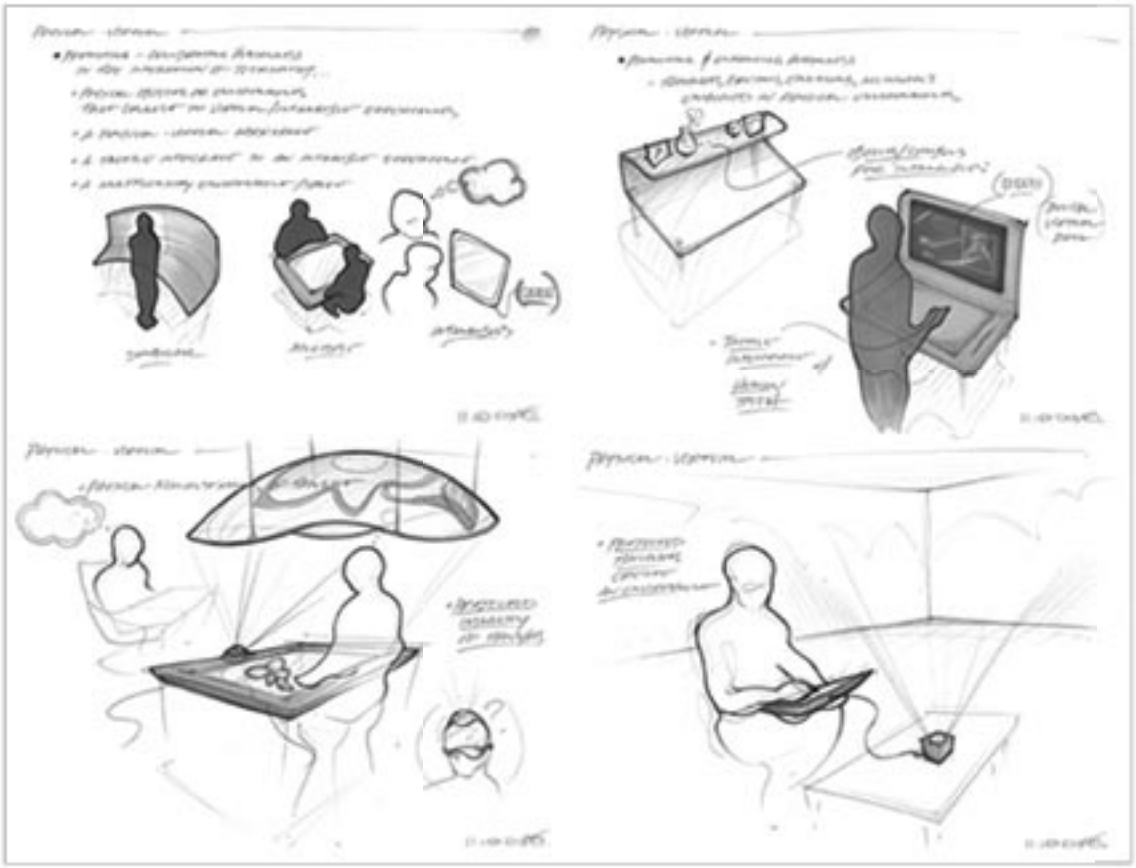


Table 5: Preliminary Concept Sketches

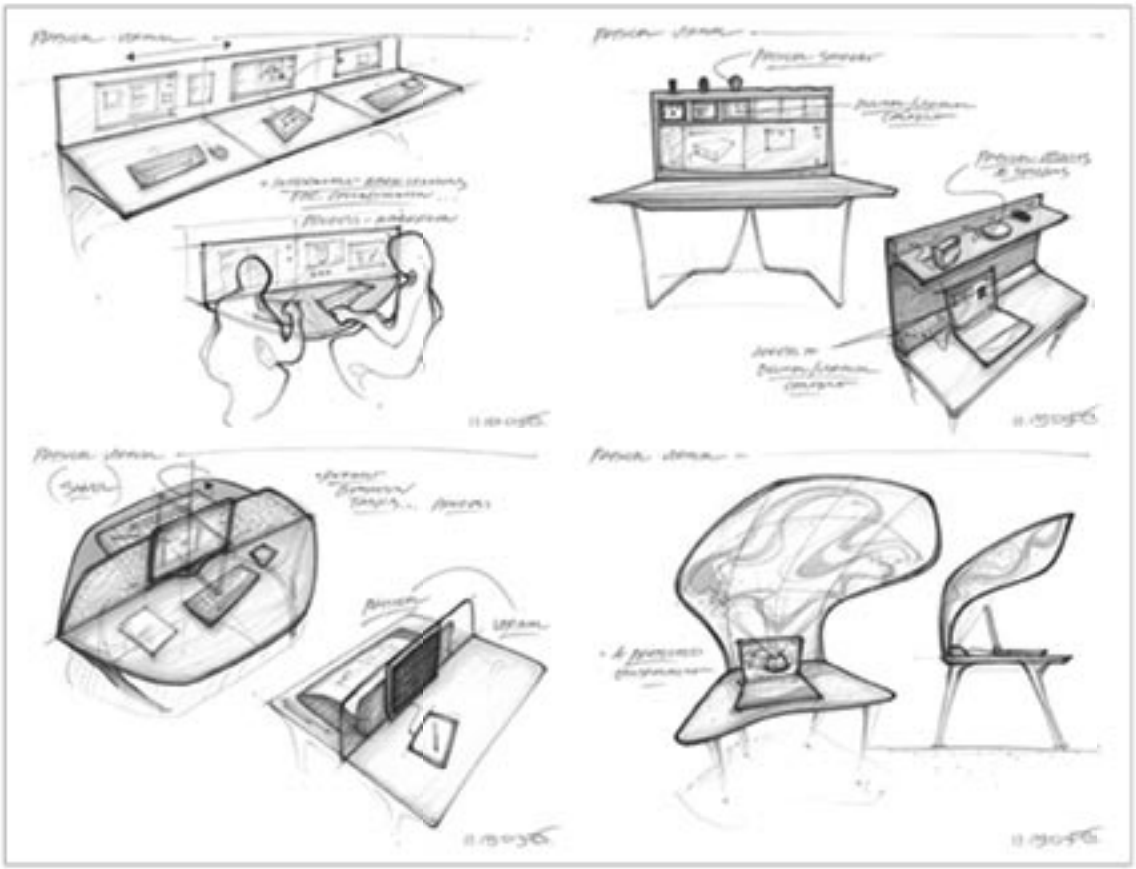


Table 6: Preliminary Concept Sketches

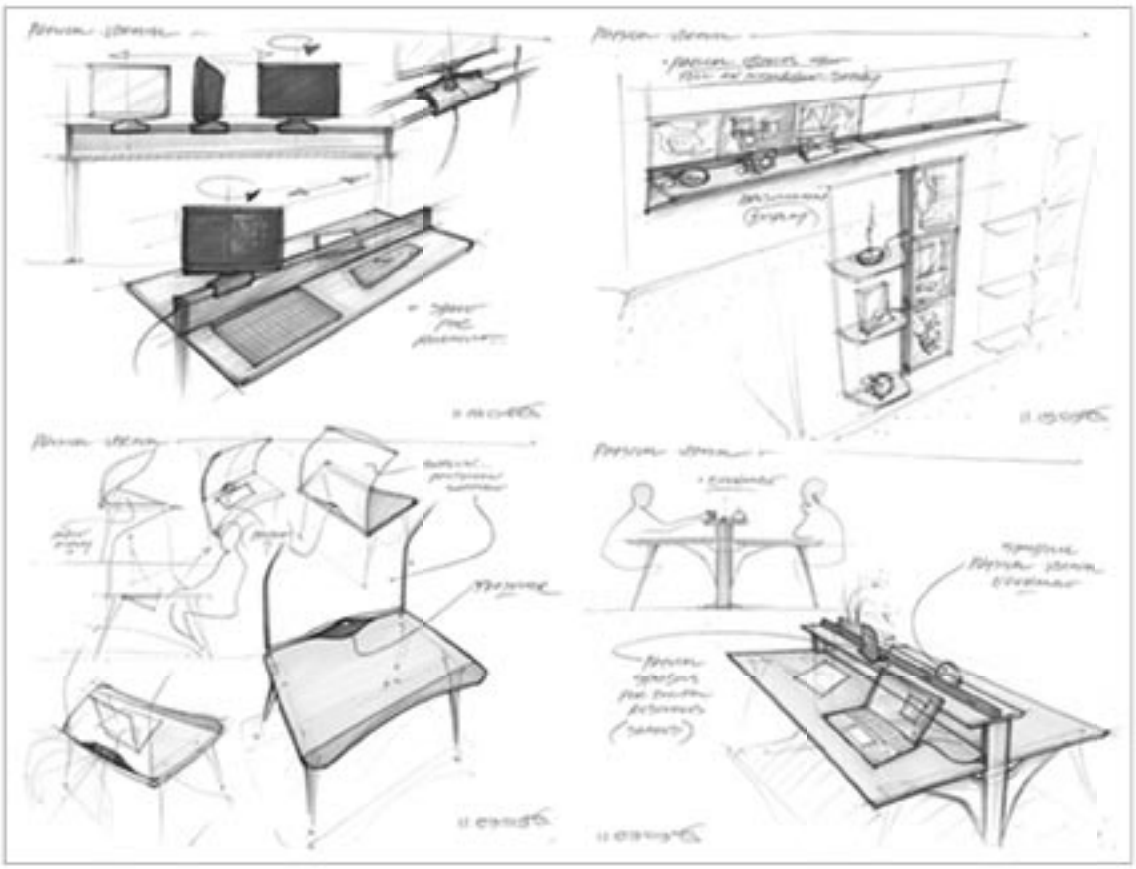


Table 7: Preliminary Concept Sketches

Table 8: Full scale concept model

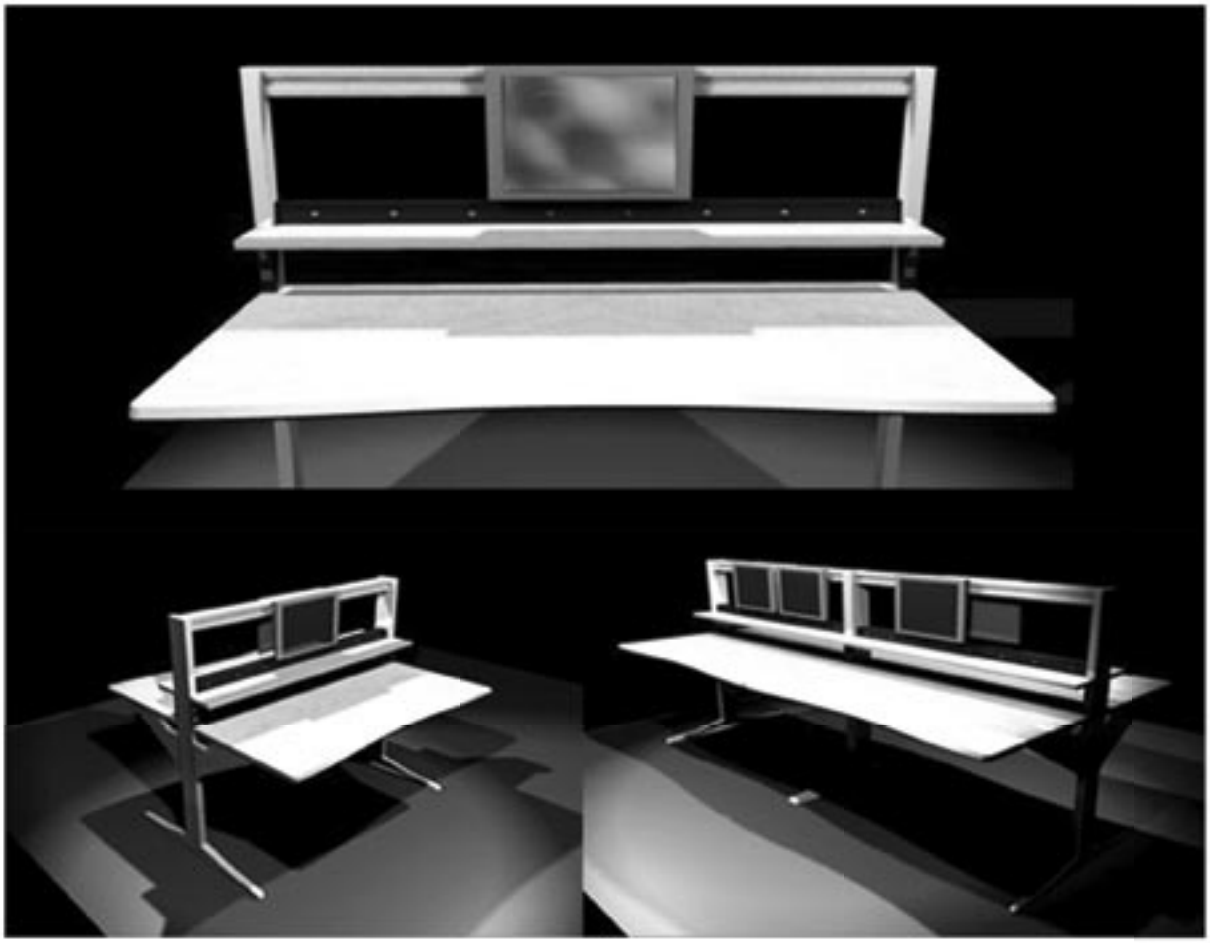


Table 9: Concept CAD Renderings

The Virtual Space

The virtual space may be closer to the intangible information space of the human intellect and nature of the imagination as it functions as a medium built essentially on a foundation of purely mental concepts of virtual information and ideas. The digital medium allows for extremely dynamic and flexible capabilities in terms of the form, composition, and content of the information experience. The virtual space is somewhat similar to the human dream space or imagination where anything is possible in terms of creating a symbolic or representative object. The virtual space is free of many of the restrictions of physical space and the 'real' environmental limitations of the physical world. These qualities lend themselves to offering opportunities for customization and adaptability, but they also represent a broad range of complexities in terms of establishing 'real' meaningful human interactions, and experiences. In addition, the virtual space is often criticized because it enables access and reference to information and experiences that are in a way separated from any particular place or time in the 'real-physical' world. This can be viewed as both liberating freedom with endless possibilities and also as an immense challenge to develop, establish, and retain meaningful connections to such abstracted mental images.

In the virtual space, context is more of a grey area that is not clearly defined in relation to the information experience. Context aids in establishing a relationship of abstract information to a relevant time and setting allowing us to draw stronger connections to the often complex sequence of mental images. Information with a contextual reference helps users to develop a more meaningful understanding with richer experiences through deeper, more engaging interactions with the virtual forms of information in the digital medium.

Virtual space, like physical space, can use techniques of abstract representation, symbolism, and metaphorical analogies to express and define conceptual ideas formed in the digital medium. The virtual space, however, must accomplish its clarity of meaning almost entirely through mental concepts formed from substance without matter. Aside from any representational three dimensional virtual forms, meaning and conceptual form in the virtual space must be expressed and defined using descriptive language, visual imagery, or other primarily intangible means. For these reasons, visual symbolism and metaphorical associations are critical to making and maintaining linked relationships of meaning in order to clearly communicate and express conceptual ideas in the virtual digital medium.

Many of the same issues of physical space will apply to the virtual space in terms of opportunities for sensorial input and affective physiological stimulation which serve as beneficial components in the process of ideation. Sight and sound are fully exploitable in the virtual space, as well as perceived 'visual' shape and form, to some degree. In addition, there has been much research and development in an effort to make the virtual more physical in terms of how humans are able to more realistically interact with digital media based information. Concepts in virtual reality, augmented reality, haptics (physical/touch-sensory input), touch sensitive force-feedback, and even scent based virtual interactions are continuing to blur the boundaries between the virtual and physical mediums of information and experience.

Such advancements are essentially pressing toward what many believe to be the future of convergence between our notions of ‘real’ physical space and the virtual space of the digital medium.
At present, however, the traditional physical medium, without any of the requirements for advanced technology, still represents a more ‘real’, visceral experience of the tangible types of physical human interaction with ‘atoms versus bits’. (Negroponte 1995)

Aside from its drawbacks, virtual space offers near endless opportunities to expand on many of the limitations of physical space alone. Such obvious restrictions include scale and the surrounding environment of physical space. However, virtual space does not have to be viewed as a replacement, but rather as a complimentary medium to our physical world. The benefits of the digital virtual medium can assist users in maintaining, managing, and enhancing the physical space. For instance, concepts which apply embedded computing technologies within ‘intelligent architecture’ seek to build hybrid environments that combine aspects in both the physical and digital mediums. Essentially, humankind is continuing to combine its expanding knowledge and technological developments from multiple fields such as the mechanical, electrical, and even the biological sciences. The creative environments of our future will inevitably continue to blend these technologies together to form highly intelligent, flexible, and multifunctional spaces for diverse human needs.

There are still many challenges in that virtual space requires many of the same aspects of planning as physical space. The internet, websites, and information systems for example must all be designed, engineered, developed and ultimately constructed as well as maintained to properly serve human users, business, and society as a whole. Issues related to the partitioning and organizing of virtual space can directly impact a users ability to effectively interact with information within a virtual environment. Digital information interfaces serve to offer users a systematic way of searching, accessing, handling, and transforming various forms of information within virtual space. Such information systems must offer tools and methods to explore, view, categorize, sort, and label information in order to create logical sequences of thought. Basically, these thinking tools help users to order and arrange information in such a way to make it relevant and meaningful to an intended purpose or goal. Without this ability to structure information in a virtual space, users can easily become overwhelmed by vast quantities of generic data. Such a result of information overload can be avoided by providing users with more customized control of the order, form, and flow of the information-based content of their interactive experience within the digital medium.

Many of the tools and methods for structuring virtual space are also used in our physical information spaces. Computer systems use notions such as labeling, grouping, visual coding with color, icons and symbols, as well as the common file and folder representation for organizing digital data. Hard drives and disks serve as volumes of grouped information that, like individual files and folders, can be literally linked to physical counterparts. Technologies such as barcode labeling, scanning and RFID tagging can be used to establish intelligent connections between physical and virtual forms of information. For example, with RFID tags, readers, and writers, users can both read and encode embedded information within electronic tags attached to physical objects that can reference related virtual information.

Such technologies for adding digital ‘metadata’ to physical objects represent the growing connectedness of our physical and virtual mediums of information and experience. With these new developments, the virtual space is becoming more responsive to the circumstances of our physical world. As a growing number of systems in the virtual information space continue to not only reference but also exchange information with elements in the physical space, tangible and intangible forms of information and experience are becoming more closely intertwined. In this way, the virtual information space has evolved to become much more interactive in ‘real-time’ to the occurrences and contextual needs of users and our physical environment.

Such technologies as speech recognition, motion tracking, and physical object tracking, among others, are attempting to develop virtual spaces to be more accommodating to the ‘real’ events of human activities and the physical world. These ‘intelligent’ information systems are able to some degree to adjust and adapt to the specific needs of users and context sensitive scenarios. However, as to their level of ubiquity or invisibility within our human experience, there may be valid concern for a loss of human control due to users’ lack of awareness to what such systems are actually doing and ‘deciding’ at any given moment. For instance, object tracking and surveillance are obvious areas for humans to be concerned about their personal privacy when such technologies seem to be increasingly integrated into the already pervasive information systems of our daily lives. In essence, these issues suggest that the careful development of virtual information systems is of significant importance to humans and society at large. For the evolution of balanced solutions incorporating the virtual digital medium, we must strive to retain the qualities and freedom of human experience that remain centered around the human intellect and creativity rather than the capabilities of technology alone.

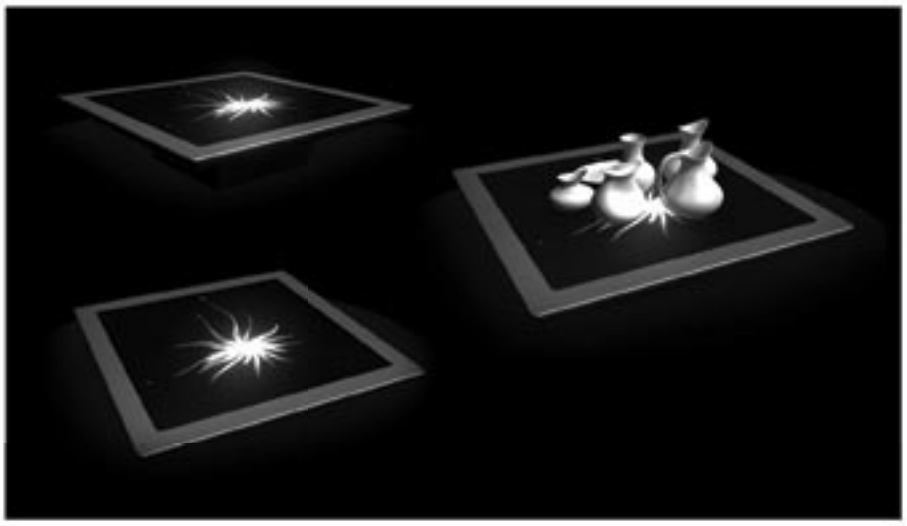
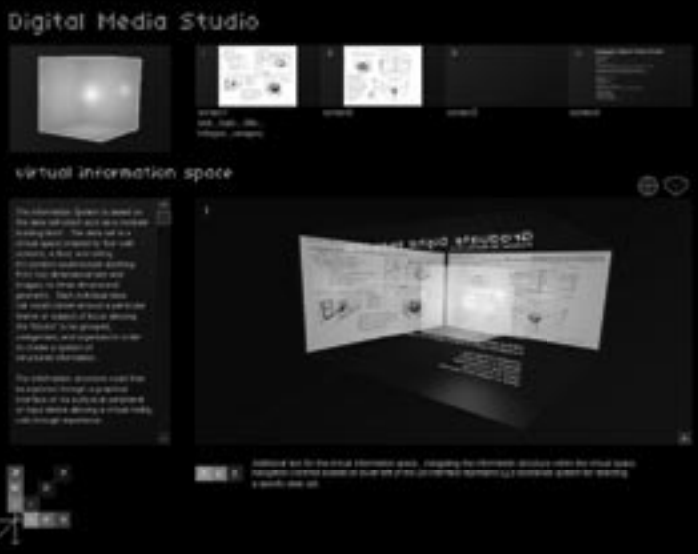
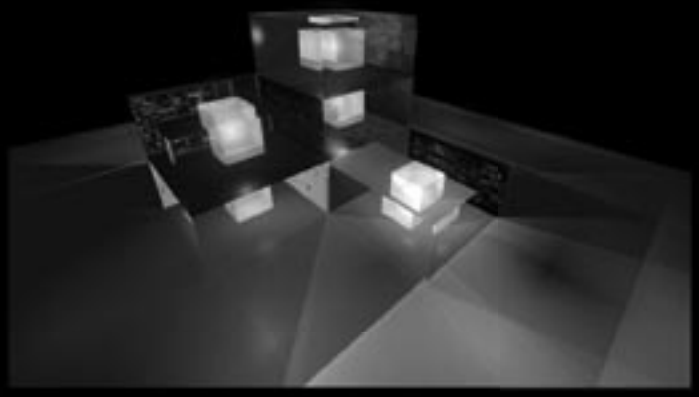
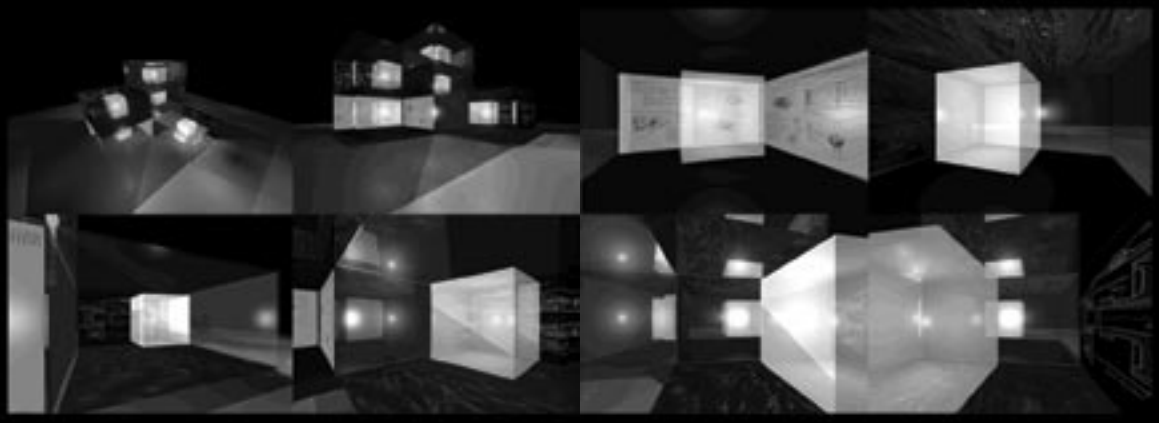
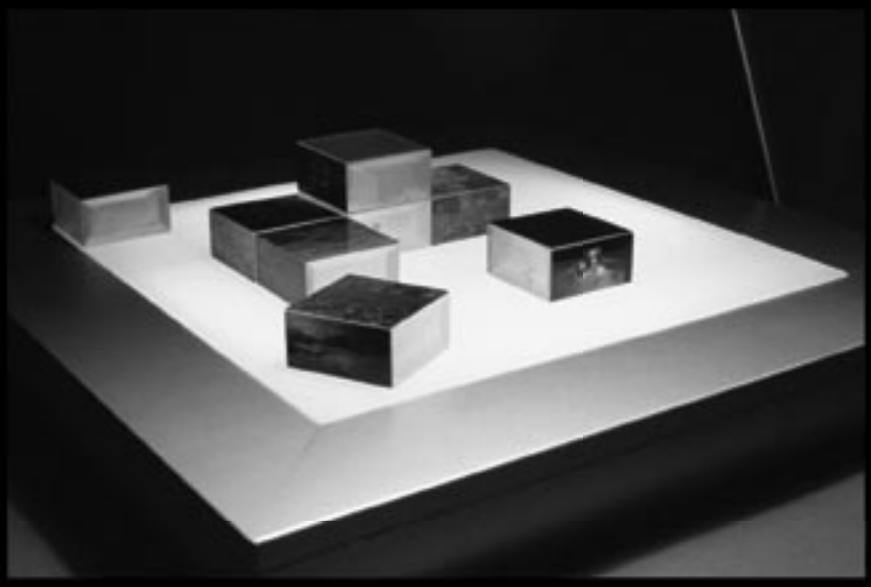


Table 10: Concept CAD Rendering









This concept for a Virtual Information Space explores the idea of creating a virtual structure of information. As a literal play on the theme of “information architecture”, the virtual information space uses a tangible grid interface with trackable ‘data blocks’ allowing users to build a virtual structure and space for their ideas in the digital medium.

Table 11: Design Concept for Virtual Information Space

Users, Groups, and Collaboration

Users, groups, and the interactions of collaborative work, represent vital human components for which both physical and virtual information spaces must be developed to support. In order to serve users in the process of transforming information, the human user must be central in the connection to both the physical and virtual space. To some degree, a creative workspace is simply a representational extension of the human users 'thinking space' where they are enabled to evolve their ideas using both tangible and intangible forms of information and experience. For instance, technological tools for computational processing of information are often referred to as virtual 'extensions' of the natural human central and sensory nervous systems. However, these assistive devices have also been compared to cognitive crutches for our growing dependency on their ability to serve as 'mediating interfaces' in our human interactions, thought processes, and efforts to communicate with one another.
(Mitchell 1995)

Essentially, both the physical space and virtual space within a creative workspace serve as the combined environment to support, shape, and enhance the overall quality of human interaction and experience whether individually or in multiples and group scenarios. In addition, this entails not only the immediate physical space of our workplace surroundings, but also the extended virtual space afforded through notions of 'networked teams and environments' that allow for what has come to be called telepresent interactions. Communicating and interacting with distant users and groups through a networked environment is now almost common within the virtual information space of the World Wide Web and the evolving infrastructure of networked information spaces. Not only is this network of information systems growing and evolving, but it has also shifted into an era of wireless connectivity which has not only expanded its opportunities for applications, but has created a sense of ubiquity in its presence or existence in our human space.

In a way, technology can be viewed as the 'third party' in our human to human interactions where it can sometimes both assist and mediate between user and group activities. For those working towards the development of artificial intelligence and context aware computing, this is not an entirely radical concept to imagine in the near future. At present however, such systems still largely depend on humans and their actions. Whether in the context of an individual user interaction or in that of a group setting, the application of the technology will be primarily driven by the needs of its human users.

The needs of the individual will differ from that of a group, in terms of the types of human interaction that will take place within the creative workspace and also depending on the nature and context of the work being done. Just as there are spaces developed for individuals as well as groups, a creative workspace must be able to suit the needs of the situational context and type of work to be done. This could be accomplished with multiple specialized zones or spaces that work together as a system or by attempting to create an acceptable amount of flexibility within a single workspace to accommodate a range of various uses. Most workspace environments will tend to involve a combination of both methods to optimize an adaptable setting.

Just as organizations, groups, and even individuals have personalized systems for organizing and evolving the information involved in their creative work, there are also systems for interaction among others in accomplishing the completion of tasks requiring a collective effort or the involvement of distinct members. There are times when such work requires individual focus on divided tasks, and times when individuals or groups must be able to fluidly interact and work simultaneously in parallel on a combined task. Information systems can serve to support users in their individual means of information processing as well as to communicate and exchange ideas within a more collaborative mode or group setting. Because of these interrelated functions, an information system and a system for social interaction are essentially similar subsystems that are intended to work together for the same purpose.

Technologies such as video conferencing and the networking of virtual teams and virtual offices attempt to offer the best of both modes of interaction where individuals can work independently, but also participate in a networked virtual experience with other individuals as a networked team. These applications are somewhat limited in that they can only utilize and share a collective virtual space, without any 'real' connection to the surrounding physical space of their separate members. Some of the greatest benefits however, are the environmental advantages of eliminating travel time and thereby conserving limited resources as well. Although these scenarios deal with a certain amount of give and take of benefits and sacrifices within their resulting experiences, they have developed new opportunities for users interacting with information and each other in accomplishing a collective goal.

This is an interesting development in that the networked notion of human intelligence represents an advanced evolution of our human ability to think, process, evolve and express our ideas as a civilization of diverse members. As compared to computers thinking for us, it is more about using these technologies to think and work together as a human network of combined talents and capabilities. Many of these issues were written about in the 1960s by theorists Marshall McLuhan and Douglas Engelbart. McLuhan was a communication theorist who initiated such ideas as 'collective intelligence within a global village', whereas Engelbart, who is actually credited for coining the term 'Collective Intelligence' and establishing the original concept of network augmented intelligence, has been widely acknowledged for his approach to 'engineering business for collaboration, knowledge management, and virtual teaming'.

Pierre Levy, author of *Collective Intelligence*, describes this phenomena as a shift from an "I think" to "We think" mentality. Although Levy's perspectives focus mainly on the developments within the virtual information space of the evolving cyberworld, he sheds light on many interesting changes brought about by the advancements in networked systems of information and intelligence and their impact on human interactions and experience. Levy describes this process of human evolution as leading mankind "toward the creation of a new medium of communication, thought, and work for human societies."
These acknowledgements view such advancements as a reflection of both intellectual and social evolution.
(Levy 1997)

Antonelli describes work itself as “how we communicate, share information and ideas.” She theorizes about the “re-invention of work from technological to sociological.” Other comments describe “public interfaces to social computer systems” as well as “interactive communication networks.”
(Antonelli 2001)

From these examples, one could perceive that the design and engineering of such creative workspaces is ultimately about developing the human interactions and experiences which they serve to support.

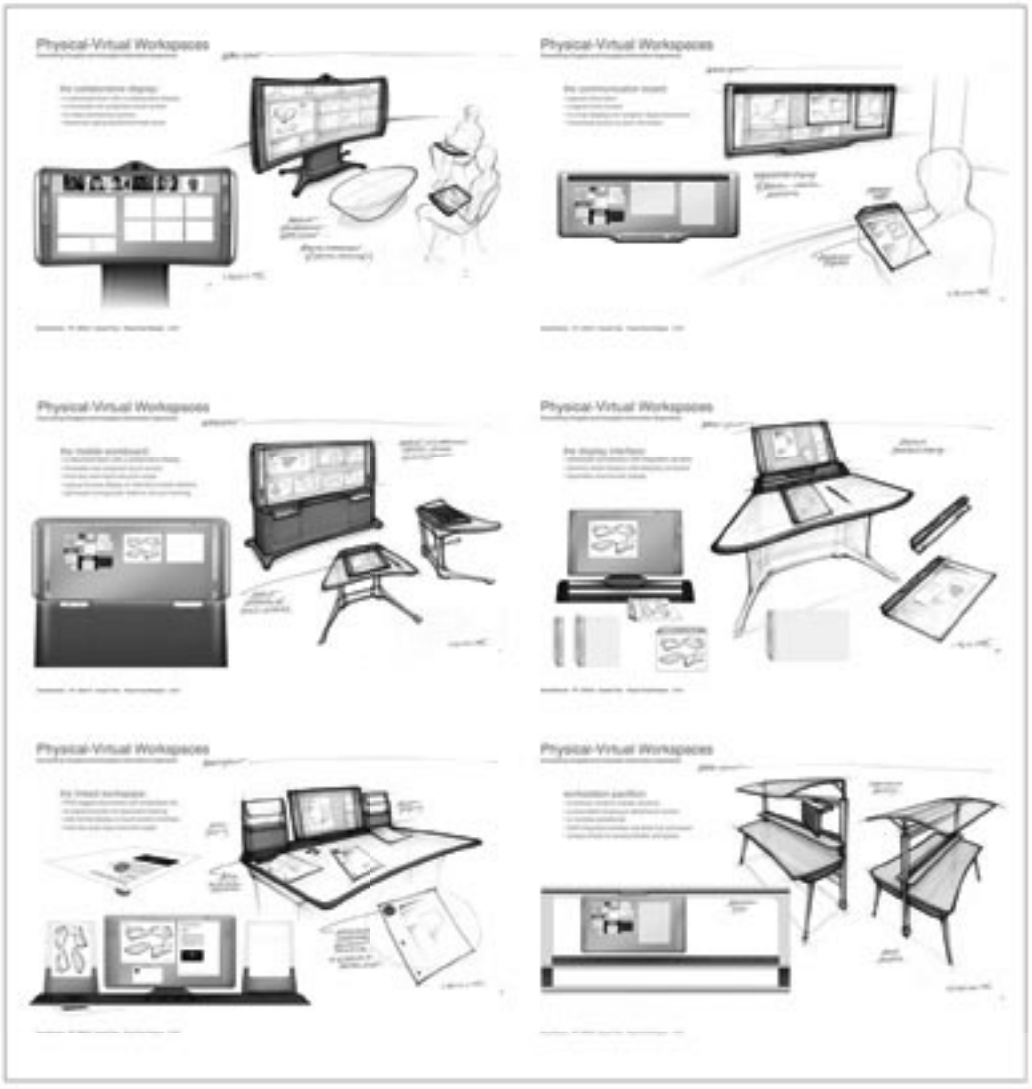


Table 12: Concept Sketches (interface)

The Information Experience

So what defines an information experience?...and what purpose does it serve?

Aside from the technology of the information interface, the whole point is to retain and possibly enhance the quality of our natural 'humanness' in terms of our interactions and experiences with each other and the world around us. The challenge is that this world is now perceived as including both a virtual-cyber world space as well as our notions of the natural physical world space. So the question is, what is our 'real' world composed of? The simple response to state that the virtual space is not part of our perception of the world around us would be inaccurate in that one cannot deny that it does indeed exist, even if it is in an abstract, and primarily intangible form. So we must accept that our world does in fact incorporate spaces which are in some ways both tangible and intangible, physical and virtual. This is not hard to grasp if we are able to acknowledge that even human thought and the imagination, entirely independent of technology and the digital medium, represent intangible and in some way virtual representations of our existence. Without placing too much emphasis on the differences between the two mediums, we must strive to refine and improve our combined and sometimes interwoven interactions in both physical and virtual space. In time, these distinct transitions between different mediums of information and experience may for the most part disappear as they become more tightly integrated and united as a representation of our human expressions and existence. After all, it is the meaningful content and the message which gives purpose to both the physical and virtual forms of information and experience. For instance, if we are able to effectively grasp the meaning of the content through interactions that successfully retain and enhance the quality of our human experiences, then the medium will only be secondary.

Given these reasons, we can see that meaning and the value or quality of the information experience is critical to maintaining and promoting positive human experiences in the development of knowledge and creative ideas. For, after all, if there is no meaningful purpose or value in the experience, then the entire endeavor is not worth the time and energy required for such an engaged interaction.

The information experience involves all aspects and forms of the information based media - both tangible and intangible, virtual and physical. This means our combined experience includes the interactions within our physical thought space and our virtual thought space. By taking this approach, the information space where the experience takes place is both physical and virtual. It possesses both tangible and intangible qualities.

In their book *Design Noir*, Anthony Dunne and Fiona Raby describe experience by theorizing that "the mental interface between the individual and the product is where the 'experience' lies."
(Dunne and Raby 2001)

Leonardo DaVinci would have likely viewed such experience in terms of sensory perception. According to Gelb's description of Da Vinci's outlook - "The keys to the doors of experience are: sight, sound, touch, taste, and smell." This was described as "Revelation through the Senses." This power of vision, or "the true eye", was described as a sensitivity to ones environment and surroundings. For DaVinci, this method of 'synesthesia' was the pathway of vision through the "mind's eye". Gelb describes Da Vinci's approach as "multisensory visualization" within "multisensory environments and experiences."
(Gelb 1998)

Postman writes that the "purpose and meaning of information is what forms an interconnectedness - unity and continuity of human experience and feelings." He describes meaning as formed by "sounds and symbols, feelings, experiences, and sensations."
(Postman 1992)

Some designers have applied many of these issues to what has been referred to as 'experience design'. This is an attempt to look beyond the obvious attributes of the product or object alone to discover and develop the actual qualities of the types of human experiences which they promote or enable. Basically, the question is not so much, What is the product?, but What does it do? and How does someone use and interact with it? Essentially, what defines the product is the very type of human experience which it provides for its users. For a creative workspace, this design of the user experience will serve to define the product solution.

So Who are the users and What types of activities are they engaging in?

Whether design professionals working in an office studio or students working in an educational setting, both user groups will inevitably be required to process and transform information in evolving their ideas into some final product or service for the demands of their work. There are times when the information experience is more exploratory and freeform. There are times when their developments are more focused and involve higher levels of filtering, sorting, and organizing of content in grouped hierarchies of order. In addition, such user interactions may often require the need to view and present accumulated ideas to larger groups for evaluation and feedback. Whatever the particular situation, each contextual circumstance will likely call for a slightly different set of functional needs required of any such creative workspace. For these reasons, it is critical that a creative workspace offers an acceptable amount of flexibility to accommodate a diverse range of users and activities in order to promote more effective and meaningful information experiences.

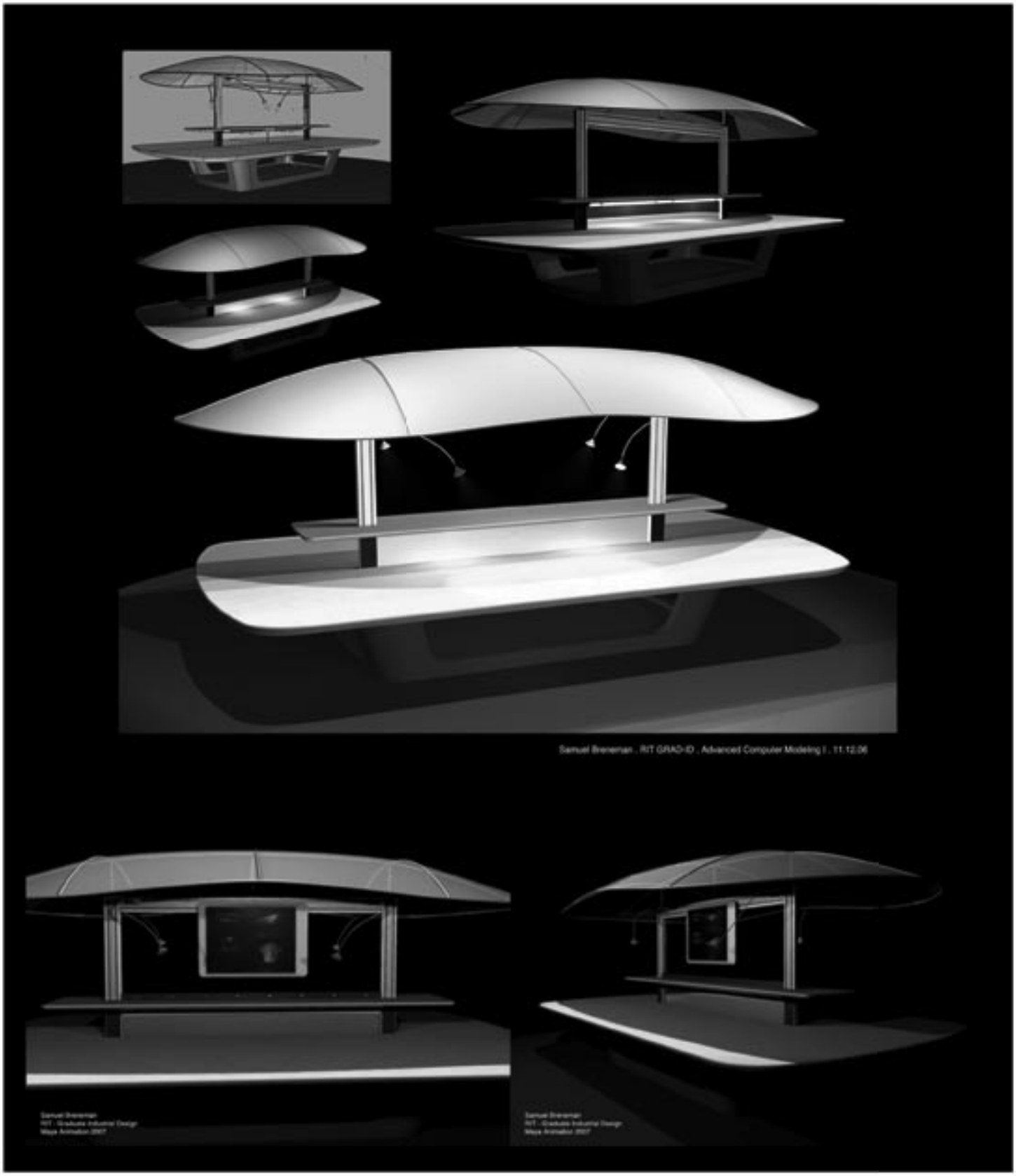


Table 13: Concept CAD Renderings

Table 14: Concept CAD Rendering

Integration within the Physical-Virtual Workspace

The question is: How can a creative workspace improve the integration of both the virtual space and the physical space? Is there a way to form stronger, more meaningful connections between the tangible and intangible forms of information and experience?

The integration of physical and virtual information spaces within a creative workspace is challenging in that it often requires the human user to close the gap between mental images that exist in different tangible and intangible mediums. The physical forms of information can be quite literal and obvious in our abilities to interact with them and explore them in order to deepen our understanding of what they represent and how they relate to us and our human needs and interests. Virtual forms of information can be more challenging in the sense that users must be much more capable of drawing upon accumulated knowledge to deduce meaning and make related associations to the virtual representations of abstracted mental images. It is simply hard for users to get their hands around virtual content in a digital medium through the common computer interface. The limited ability to physically interact with representational virtual objects and forms of information make it all the more difficult for users to establish a meaningful understanding and to discover relevant connections to these symbolic concepts.

As an example, the concept of 'tangible media' is targeted at improving the human ability to interact with virtual information in a tangible way. Hiroshi Ishii, a leader in research at MIT's Media Laboratory, has developed a Tangible Media group with multiple projects aimed at designing 'seamless interfaces between people, digital information, and physical environments, by giving physical form to digital information'. Their projects attempt to 'exploit the human senses of touch and kinesthesia' in an effort to improve the human to information interface. This field of research is a strong clue that indicates a progression towards a point of integrated convergence of physical and virtual forms of information and experience.

What happens when virtual digital information is given or rather linked to a representational tangible embodiment in physical space? How does this impact the virtual space, the physical space, and the unified creative workspace that is intended to support the human users?

The concept of tangible media applies technologies such as physical object tracking using both optical systems and sensor based nodes to make and maintain what could be called 'literal connections' between physical objects and related forms of virtual digital information. In this way, the technology assists the user in drawing meaningful cognitive connections between physical symbols and their related mental images in the virtual information space. For example, the placement or movement of objects in physical space could potentially trigger certain actions or functions in a connected virtual space of the digital medium. In addition wireless technologies now allow for such seemingly invisible connections to even take place in near real-time for entirely new forms of interactivity.

As an example of such applications connecting tangible and intangible forms of information and experience, my research and design explorations include a related project specifically for the development of an interactive virtual information space. The design concept combines a virtual workspace with a tangible physical interface that would allow users to build and configure a virtual information space within the digital medium by manipulating an electronically linked set of intelligent building blocks. Each data block would be assigned individual content through a computer interface and then physically arranged on a grid-like peripheral which would track each block corresponding to room-like data cells within the virtual information space. The resulting virtual structure in the digital medium represents a literal play on the idea of information architecture. In the concept, users can create a building like form which could then be navigated and explored through either a computer based interface or by using various types of virtual reality technologies to walk through the three dimensional virtual space. The overall idea challenges traditional notions of a 2D experience of information. For instance, one can imagine our current view of the Internet with its World Wide Web of primarily two-dimensional websites, and then envision a future when this cyberworld might become much more three-dimensional in terms of how users are able to interact and navigate it in their explorations.

The continuing advances in such digital information interfaces have created many new possibilities for users to engage in an endless array of enriching information experiences. Technologies such as speech recognition, optical tracking, touch sensitive displays, and multi-touch input display interfaces now offer previously unimaginable opportunities for humans to interact with information based systems in richer, more intuitive ways. Multi-touch input devices, for instance, can track and respond to the touch of multiple users simultaneously enabling more of a group type of interaction with a single computing device. In a way, there is now even greater potential for such information interfaces to become more communal in their ability to provide multiple human user interactions.

Such explorations in information interfaces essentially strive to improve our methods for handling and interacting with information. These efforts to develop the systems, processes, and structures of both tangible and intangible forms of information have established such fields as human computer interaction and information architecture as a critical components in the design of intelligent information based systems.

In order to improve the information interface and its integration into the physical-virtual workspace, relationships between mental concepts must be strengthened by relating aspects of the virtual information space to the systems architecture of the physical space. In a way, the two systems must be designed as a whole interrelated, interconnected networked structure capable of establishing intelligent, cognitive connections between objects and concepts that are both tangible and intangible. The result is an information system whose virtual ‘architectural system’ is directly related to the surrounding architecture of the physical space.

This notion has led to explorations in intelligent, ‘context-aware’ physical spaces integrated into architectural settings and environments. Such systems can literally track physical objects including human activity, while offering assistive technology based processing and computing resources to deliver helpful information to users in relation to both time and setting. There are however obvious implications that should be given careful consideration in regard to the social and psychological impacts on human behavior which would inevitably result from the application of such ‘omnipotent’ artificial systems potentially taking control over the lives of humans. Although such concerns could be justified in extreme cases, current research and development in areas such as artificial intelligence are still struggling to prove their abilities and gain acceptance as dependable technological aids for human users.

So how can we form such integrated connections within physical-virtual information spaces without detracting from the overall quality of our human experiences?

For many, the answer to successful workspace solutions involves equal development of the physical space, the virtual space, and the organizational systems which guide human activity. In essence, these interrelated systems must work together towards a common goal. To some degree they must work together to form a greater whole as an interactive and dynamic system.

In his book entitled *Valueware*, Christopher Barnatt describes the combination of hardware, software, and human activity as organizational valueware. Barnatt explores this concept of valueware as an attempt to “maximize the overlap of structure and process.” Organizational valueware is described by Barnatt as a connectedness of both “organizational hardware and organizational software” that is moving towards the “convergence of technology, humanity, and organization.” In his writings, Barnatt explores “the productive interface of hardware and software” as well as “patterns of collective human activity.” Barnatt essentially explains that the purpose of valueware is to mutually develop “technological value, social value, and organizational value.”
(Barnatt 1999)

Future developments for a balanced integration of physical-virtual information spaces may likely combine the most acceptable levels of computer or machine mediated experiences in parallel with the optimum level of physical human user interactions. Most users seem to be willing to accept such information based technologies as long as they are ‘assistants’ versus the controlling component within human activity. For any solution to succeed, such technologies must place the focus on the users versus the machine.

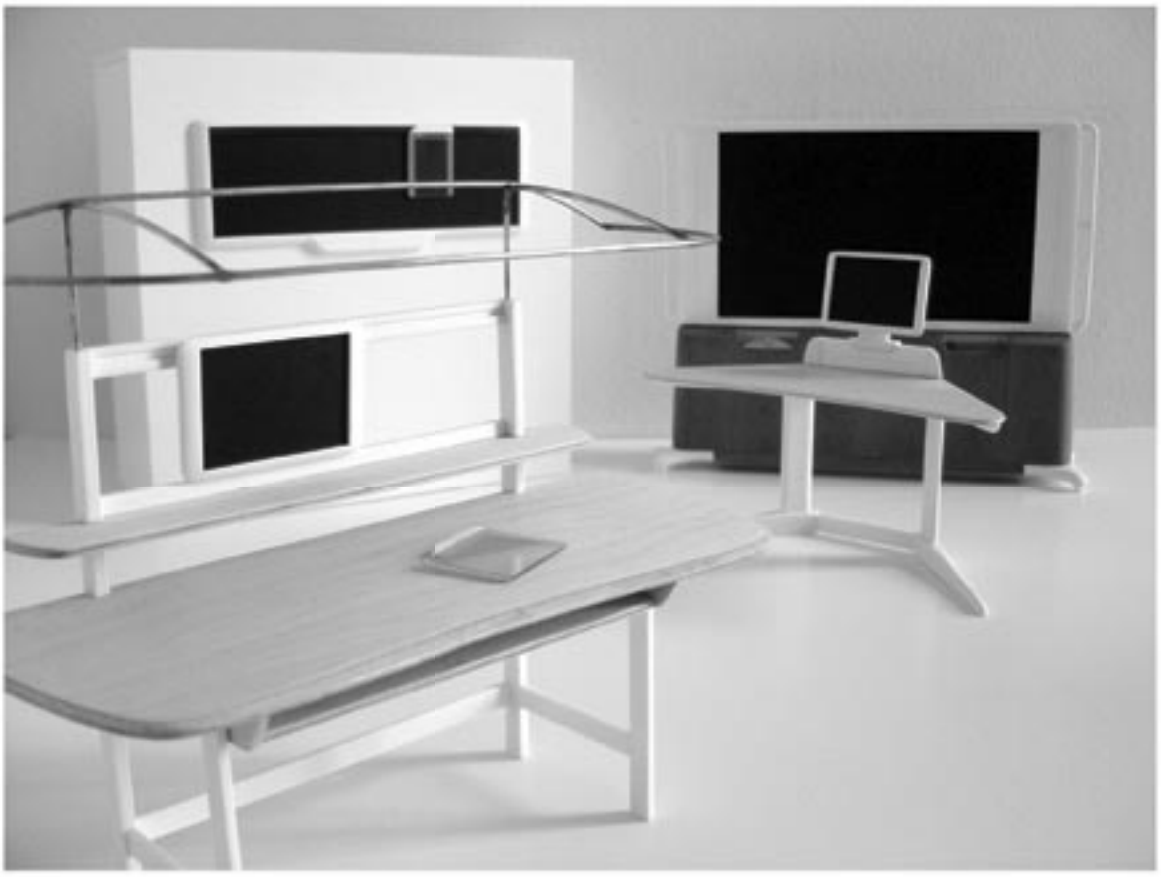


Table 15: Concept Models (1/8 scale)

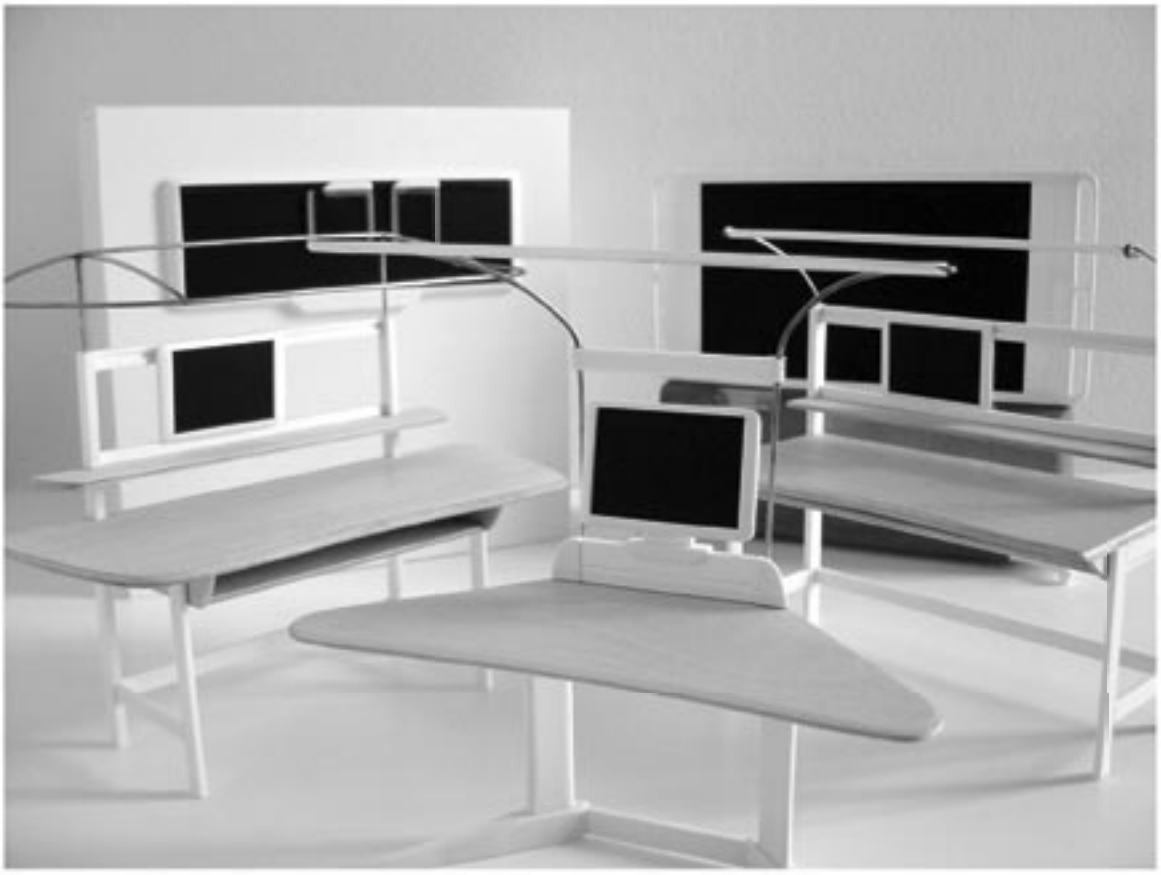


Table 16: Concept Models (1/8 scale)

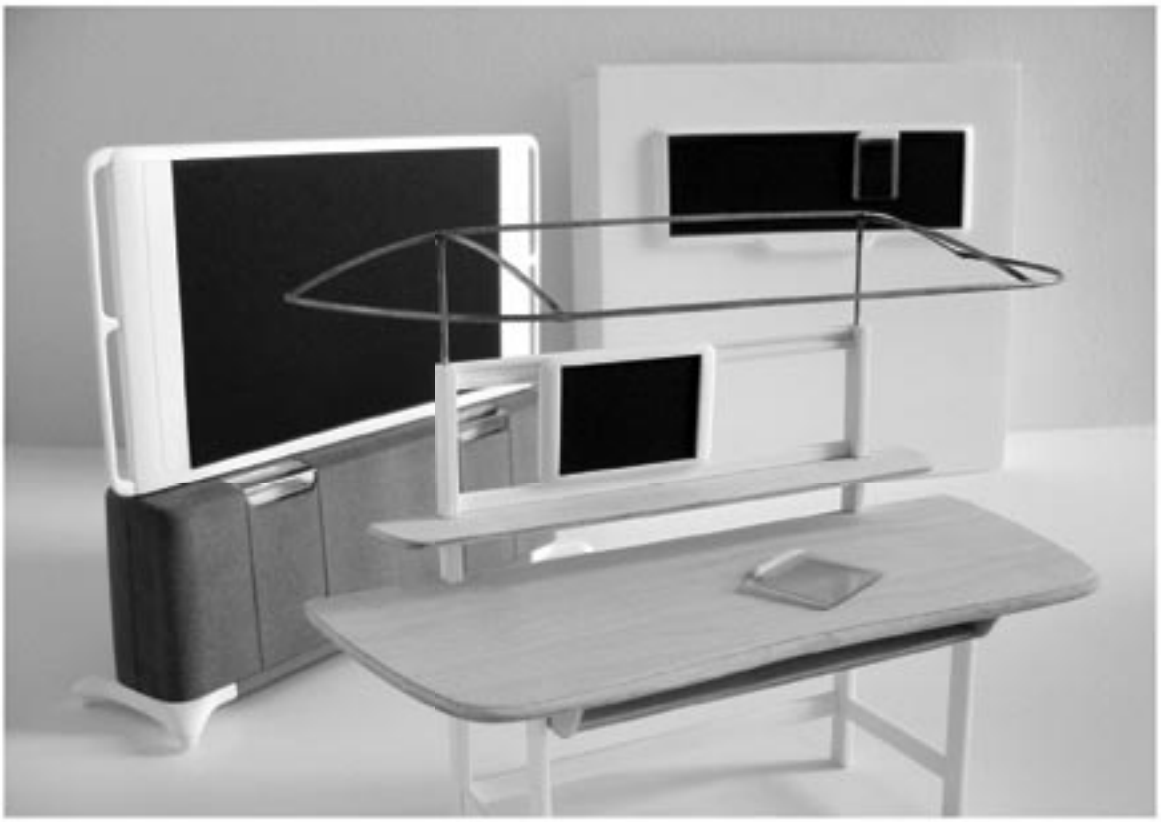


Table 17: Concept Models (1/8 scale)

Table 18: Concept Model (1/8 scale)

Analysis

In review of the research, it is apparent that there are many issues to consider in the development of a creative workspace. Components such as the physical space, the virtual space, and also the critical human factor of interaction must be collectively shaped for the needs of human users. To knit all critical elements together for a successful system, there must be a careful balance where the human user experience remains the central focus.

The historical references to developments in the workspace environment suggest that there have been many advances since the first introduction of computers and the digital revolution to our traditional physical world. As we are currently in what many consider to be the growing age of information technology and the knowledge economy, these changes in our workspaces and literally in the way we go about our work are likely to increase well into the future. In light of these transformations, management theorists such as Peter Drucker have offered many insights in regard to the shifts of human civilization through the eras of an agricultural land based economy, the industrial economy, and the present knowledge based economy of today. Much of these studies point out the movement of business and industry production to be moving away from material goods and products and toward information based services and the development of knowledge and intelligence as a product for economical growth. For the majority of these knowledge workers and even the wider general population who depend on the quality of these goods and services, the design and development of effective information based systems and interfaces is therefore critical for the success of business, education, and the benefit of society at large. There are many obvious benefits from being able to access valuable information at the right time and place in order to make informed decisions. Whether building an education, researching information for a new product purchase, or collecting reliable information for medical conditions, the quality and reliability of such information can be of great value. In addition, such information systems allow humans to record the experiences of their lives, which not only captures valuable memories, but can also serve to build knowledge through shared experience.

In order to make further improvements, it is important to note that many early developments in the design and development of planned workspaces seem to have been focused primarily in regard to the physical workspace. It seems that there is a need for equal development and integration of current technologies in the virtual medium as well. Most importantly, there appears to be a lack of solutions which combine both the physical and virtual thought spaces within one integrated workspace environment. Many office areas tend to cater to either one or the other without a balanced connection between the two mediums of tangible and intangible information.

In response to this need, my explorations have looked at how to better place virtual information spaces and technologies within the physical workspace environment where users can access both thought spaces simultaneously in their creative process of exploration and ideation. For example, several studies looked at physical desktops and worksurfaces that included digital interfaces to virtual information spaces. These concepts attempted to integrate features such as

digital displays, projection systems, power and data port connections, and various methods for user interfaces that allow for input and output between tangible and intangible mediums. The overall premise is that if users are able to work more closely between the physical and virtual mediums of their ideas, it would improve their abilities to form stronger, more meaningful connections throughout the experience as well as promoting a more free and fluid flow of thought and execution within their creative process of transforming various forms of information and ideas.

As an example, many users commented that translating physical forms of information such as three dimensional material objects into the virtual medium was a struggle. Although there are a range of tools available to reinterpret tangible media into digital mediums, they are for the most part unable to fully capture the truly physical qualities of being able to interact with these representative ideas in a physical way. Users cannot actually feel what it is like to literally engage an idea when it is in a virtual intangible form. Technological tools such as digital cameras, 2D scanners , or expensive 3D scanning equipment do not yet offer users the ability to capture the finer details of physical experience which include scent, the feel of a texture, surface finish, or form, or the actual qualities of what it is like to physically interact with such an object or idea in real-time and space. These combined qualities are important when it is necessary to communicate the meaning of our ideas to others.

These issues suggest that the virtual medium is best viewed as complimentary to physical space in that real physical interaction is still often preferred and to some degree required to fully understand our ideas in relation to the real world and ourselves. In essence, the best qualities of the virtual and physical mediums should be used together to maximize their effectiveness.

Workspace concepts that incorporate more physical and intuitive types of human interaction seem to be preferred in that they offer convenience, ease of use, and an overall natural way of engaging in an information experience. Some of these evolving technologies include touch sensitive displays, stylus inputs and pen tablet PCs, and multi-touch display inputs. The benefits of these new interface technologies do not necessarily replace the quality, efficiency, or effectiveness of more traditional methods of input such as tactile buttons, switches, keyboards, and mice which are also capable of functioning as wireless devices. Such developments simply provide more opportunities to create optimized solutions catered to the specific needs and applications of our human activities.

For many users, it is a challenge to unify their different forms and modes of work as they utilize PDAs, laptops, sketchbooks, three dimensional models, and many other types of information based tools in their creative processes. Additionally, they may be challenged to combine work that they tend to develop in multiple areas, locations, or environments. Users' workspace preferences can vary between being mobile or stationary depending on the mode of work or interaction which it requires. Part of the problem is that many workspace solutions lack the ability to be both mobile or reconfigurable as well as serving as a stationary structure that can provide the sense of personal space and familiarity of a dedicated workspace setting.

To address some of these issues, my design concepts investigated different forms and levels of both mobile and stationary solutions within a workspace setting. These ideas ranged from light weight movable laptop stands to larger movable touch screen displays. Each concept suggests certain types of individual or group activities which it would tend to support. Finding an acceptable balance within one solution was found to be quite a challenge. Through the investigations, what evolved was a group of representative workspace designs that worked together as a system as opposed to an individual solution.

Each design concept offers a certain amount of flexibility and a level of customization for the users, but does not necessarily attempt to serve all potential purposes and applications within one single design. I tried to look at how one product solution might work in combination with other concepts to create new systems for human interaction and information based work. Some concepts offer flexibility through moving components or adjustable displays within the immediate workspace where other aspects of customization are acquired through simple reconfigurable arrangements with other workstation units. For instance, several concepts work both as individual stations as well as group clusters that can take the shape of an assembly line, island, or a winding chain of connected workspaces to accommodate a range of needs and workstyles. With this approach the arrangement of the workstation units can form a combined workspace environment for physical, virtual, and social interaction. The idea is that the structure of the space guides the flow of information and human interaction.

These strategies attempt to form greater value through the combination of multiple solutions. The idea reflects aspects of human interaction and teamwork within an increasingly networked world. Some of the design concepts highlighted these qualities within the immediate or surrounding physical space where as other concepts considered spaces optimized for applications of separate virtual teaming with technologies like videoconferencing within a networked environment.

In essence, the conceptual explorations have attempted to address how people interact with information and each other as they develop their ideas within the creative workspace environment. Many of these concepts consider the multiple zones or areas within individual spaces that tend to be optimized for certain tasks or applications. Whether for viewing, storage, display, or construction, these distinct zones can assist users in establishing a meaningful order and structure to their combined thought space and working processes. Several concepts have addressed these distinct areas as interfaces where information is exchanged or moved from points of input or output in the information system. To support such multi-modal processes, these concepts structure the workspace according to the distinct modes of the users activities.

For workspace concepts where the exchange of information is a central activity, there was an attempt to provide multiple forms and means for sharing or transferring the information based media. For example, a concept for a large interactive touch screen display board allows users to arrange and compose the information based content directly

on screen with the ability to print out or scan in paper based hard copies of related works. Other systems explored the ability to combine large primary display interfaces with smaller detachable displays that would serve as more tangible mobile forms of a smart document. Several variations of these concepts also considered the layering of information which would further allow users to create ordered arrangements of their information based media by overlaying multiple ideas.

In the concepts which incorporated different types of static as well as mobile representative displays, there were more apparent opportunities for a wider range of user interaction within the creative process. As an example, concepts for a lightweight dynamic display in the form of a hand-held smart document would allow users to view or share an idea as well as having the ability to update or edit the information in a more dynamic way. Such concepts served to work in conjunction with other fixed display sites where users could view and interact with a larger, more comprehensive representation of related information. This approach set out to address the needs for users to access both a birds eye overview as well as a page by page focus of their work as they move through their creative process.

Several concepts attempted to reflect user processes and workflows in the arrangement or partitioning of the physical space. One concept in particular shifts from a horizontal table like configuration to a vertical presentation board to suit the contextual needs of its' users. In this design, orientation alone has a direct impact on the type of human interaction it tends to encourage. Within the same spectrum, another concept treats worksurface components as building blocks in a flexible building system. A three piece set could be arranged for a small lightweight workstation, an L-shaped workspace layout, or a group meeting table among others.

In my exploration of workspaces and user interactions, I also developed concepts that afforded varying levels of customization within their structures to accommodate different user preferences and working modes. For example, several workspace concepts include overhanging canopies, vertical screens, or pin-up boards that could be added or removed to cater to the needs of the user or group scenario. These elements contribute to certain qualities of privacy, notions of security and shelter, and even serving to create a stronger sense of a unified space for both users and groups. In a way these movable partitions and displays help to arrange the viewable space of the workspace environment. By guiding the focus of its users, these workspace concepts can serve to direct viewers' attention for privacy and focus or open exchange. For instance, movable digital display screens allow flexible positioning for individual user needs as well as the ability to create a presentation space where a user can share and communicate their ideas to others in a public setting.

These aspects of dynamic, reconfigurable workspaces also evolved into concepts which could be broken apart for certain elements to allow more mobile activities. Several designs incorporate tablet PC interfaces that can be docked and separated from the main workspace structure. With wireless keyboards and mice or presentation style remote controls, such workspace interfaces could become much more adaptive to suit the changing needs of its users'

activities whether locally or abroad. Ultimately, such concepts attempted to use this flexibility to produce workspaces formed out of a combination of elements as opposed to one singular fixed solution.

In further development of my designs for a physical-virtual workspace, the virtual information space was treated as an interface where users could access, view and manipulate digital media based content within the surroundings of the physical space. These virtual information access points took shape as displays, portable tablet PCs, and concepts for smart documents that attempted to serve as a middle medium of both tangible and intangible media. One concept in particular challenged the intangible form of a common website or blogspace by creating a networked display board with more of a physical presence within the workspace environment. This design concept offers opportunities for users in multiple networked locations to post and view shared ideas with the added ability for team members to view the collected posts as a physical-virtual montage within a dedicated office or studio space. The fixed touch screen interface of the stationary networked display board serves to offer both freedom for expression and unity within the virtual and physical workspace of its users.

Another concept combines a set of networked tablet PCs with a large display screen and video conferencing technologies to serve as a shared interface for joint work and communication between both local pools of users as well as teammates working abroad. The large format touch-screen display would show a representational overview of all individuals work as well as providing visual cues to team members connected over a network from other locations. This concept attempts to provide its users with a flexible workspace that allows them to work both individually and in groups as well as the ability to work locally and abroad. The combined elements of the workspace concept help the users to execute their work with individual control, work collaboratively with their teammates when necessary, and communicate with others in exchanging information and ideas.

These workspace concepts build off of the notion that when individuals are more aware of their roles, functions, and contributions within a larger interrelated network, it often benefits both the sense of connectedness and purpose of both the individual worker as well as the wider cooperative system. By applying concepts for viewing a group's collective work, the creative workspace can serve to not only unite the collaborative work, but the workers as well. Having this type of big picture overview of the shared project work helps to add meaningful connectedness within the creative work while also developing a stronger sense of the shared effort involved in the combined users' experience. In addition, there are further benefits of offering users a higher level of awareness of the multiple events and ongoing evolution of their collective work in regard to the needs of project management. Essentially, the information interface helps users and groups to communicate what is going on between parallel user activities in relation to a specific timeline as a project progresses. In a way, this workspace concept blends physical architecture, software driven technologies, and human interaction to form a creative environment for knowledge based work.

In the majority of my design explorations, the information interface was where the physical and virtual forms of an idea came together for the users to combine their ideas in a creative process of transformation. The workspaces serve as a stage for an interactive experience which combines the tangible and intangible aspects of an expressed concept. Having both the physical and virtual information spaces available to users for direct references provides more meaningful connections between ideas in the digital medium and the tangible forms in the material medium. In addition, these spaces serve to provide users with an intuitive way to draw and compare the relationships of virtual information and ideas to the real life context of their surrounding physical environment and themselves. This brings increased relevance to the virtual content of the digital information space. When the ideas become connected to the users and their interactions with each other and the world around them, these concepts gain greater value as well as a higher level of purpose and effectiveness in their ability to positively influence the human experience.

In essence, the creative workspace allows users to explore, develop, and share their ideas with others. The users are in effect creating and communicating stories which combine both tangible and intangible forms of information and experience. Ultimately, the shared ideas allow for a shared experience in the development of knowledge for mutual human enrichment.

To provide an optimal setting for these experiences, several workspace concepts attempted to create an accommodating environment for user interactions by adding features like integrated overhead lighting within the unit's structure. The built in lighting allows a unit to be moved, reconfigured, or clustered with other stations while ensuring that the users immediate lit environment is retained within the surrounding space. Such aesthetic attributes within the workspace environment not only serve to shed light on the work, but they also can contribute to the experiential qualities and mood of the users within the space.

Additional technical features such as modular extruded frame components would further allow for user customization within the workspace setting. Depending on the particular needs and preferences of the users and their applications, such modular components provide the ability to attach additional shelving, storage features, displays, and so on. With integrated power strips and data ports for connectivity, these concepts for movable workstations are able to retain their supportive qualities as mobile, reconfigurable units.

Other details within some of the workspace concepts include integrated code scanners for the ability to track or sync tangible documents and objects with related content in the virtual information space. These barcode scanners or RFID readers could be used with either printed barcodes or RFID tagging systems to literally connect physical forms of information with their virtual counterparts. An early concept for instance, proposes an intelligent display shelf capable of displaying customizable digital content in relation to a given physical object tagged with an embedded chip with corresponding metadata. In this concept, the display shelf essentially serves to tell the story behind a particular object or idea. For example a person could walk up to the display shelf with a tagged object and simply place it on

the shelf where it would be recognized and read, and then the object's embedded data would be presented on the integrated display.

With such ideas for tagging physical objects and media with metadata, there are finer issues related to the tracking of peoples personal objects and themselves. If there was a way to balance such concerns with the benefits such systems might provide, these concepts could serve to create workspace environments with extremely high levels of interactivity between the physical and virtual worlds. As an alternative however, another concept could function in a similar manner through a more obvious USB plug in connection to exchange or pull up related virtual functions. This option could avoid issues related to the undesired tracking or passive reading and writing of embedded information using RFID tags. These ideas do not suggest that a workspace cannot be effective without the implementation of such technologies, but they simply point out the possibilities of incorporating such methods for connecting physical objects with virtual data within a workspace setting.

In the design concepts which include points for input and output such as 2D scanners and printers, there are obvious benefits in a users ability to be able to conveniently move information between the physical and virtual mediums. These options are primarily focused on paper based media to exchange text and imagery and would therefore be somewhat limited in their ability to capture or translate information related to three-dimensional objects. As there is a concern to keep the reality of any proposed design within the bounds of realistic costs for the end user, these options may serve as the most cost effective means to move information between tangible and intangible forms. Digital cameras could also serve as secondary tools used to capture information to be used in the virtual information space. For the most part, higher end 3D scanning equipment would most likely fall outside of the common price range of most users in the focus group of this project. However, 3D printers as well as 3D scanners are becoming more common within the workplace setting, and may one day be offered at lower costs making them more commonly affordable.

For the concepts which incorporate large digital display screens, the greater investment cost might be absorbed by the larger groups who would be purchasing them for specific applications of intensive collaborative activities. The design concept for a mobile display board for instance, might serve well as a classroom or studio presentation board where users could both collectively view and interact with a virtual information space. In addition, an integrated 2D scanner and printer would provide the ability to input and output any related information within the workspace. As a mobile unit, such a workstation could serve to create a meeting space within almost any setting.

To complement the larger display surfaces, individual tablet PCs could be used for individual users to work and move about freely in their creative process. With wireless connectivity, these units could communicate and share information across a network using the larger displays to view the concurrent work of group members. In addition, the concepts for the more lightweight workstations could provide temporary worksurfaces with port docking for laptops and tablet PCs. The integrated data ports could potentially offer wireless connectivity to attached devices to further unite the workspace components.

This idea of creating a connected workspace environment applies to the relationships of the users as well as the tangible and intangible work. The concept for a networked display board for instance serves more as a communication tool that attempts to unite the work and the workers activities. As a networked notion of an office bulletin board, messages could be posted and edited to offer an overview of the group's combined activities. The supporting smart documents could be used as a means to download or upload content directly through the physical interface of the networked display board. This concept builds on the idea of a net accessible website, but adds a level of physical human interaction through giving the networked display a location and physical identity within the shared workplace environment where people can come together to view and exchange ideas.

Together these workspace concepts serve to create more meaningful relationships between the work and the users. As tools for connecting the tangible and intangible forms on information based work, these concepts collectively function as a specialized system for processing information as well as providing a system to support human user interaction and collaborative thinking. By providing a range of workstations with tailored capabilities, this concept for a product system offers users and organizations a way to build customized workspace environments to suit their specific needs, preferences, and applications.

Summary

In summary of the research, exploration, and design developments of the overall project it is clear that a combined product system will best serve to provide users with an optimal balance of flexibility and functional capabilities within a creative physical-virtual workspace environment. By proposing a group of workstation units that work together as a combined system, there is value added to each individual element as well as the unified group. This concept for a creative workspace reflects the nature of both individual and group collaboration within an interactive experience of information processing and knowledge development in physical and digital mediums.

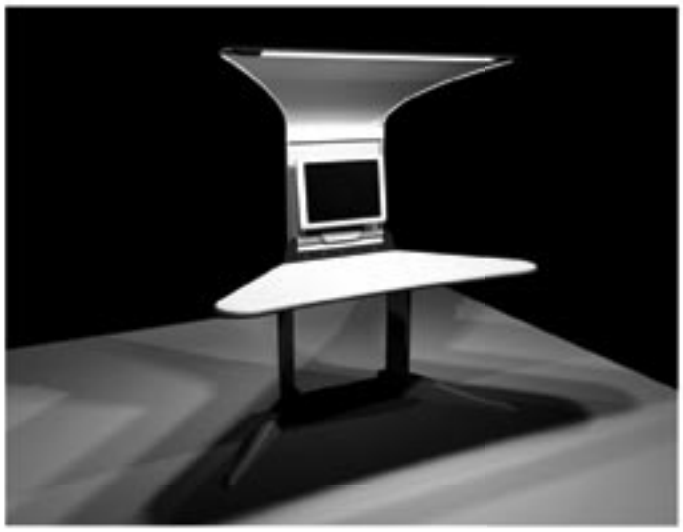
Key points from research:

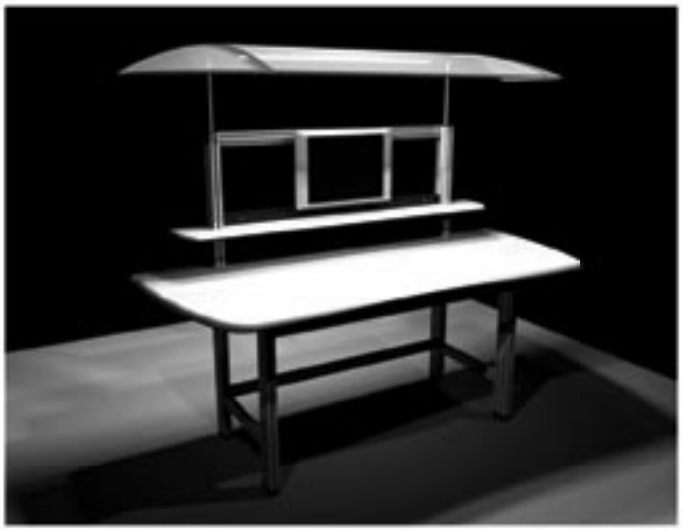
- workspaces need to improve the connections between tangible and intangible forms of information and experience
- workspaces must support the needs and activities of its human users
- workspaces should serve as supporting structures within a combined organizational system for information processing
- physically tangible and intuitive user interfaces are considered to improve and enhance the overall user experience
- mobility is an important attribute for users whose creative process does not take place within a singular space or environment
- contextual references can develop more meaningful connections between information and user experiences in the physical and digital mediums

Findings from conceptual exploration and design developments:

- flexibility is a critical attribute for any workspace solution to be effective in adapting to the needs, activities, and preferences of its users
- a workspace must provide adequate physical space for users to develop their ideas in a spatial manner with tangible mediums
- connectivity to both physical and digital work and other users is critical for collaborative knowledge work
- virtual space cannot serve as a complete replacement for physical space and interaction, but can act as a complementary medium
- linked RFID object tracking offers many opportunities for interactions between physical and digital mediums, but raises many concerns for user's privacy and sense of control
- users often prefer the ability to view and interact with information in a tangible way
- integrated features such as scanners and printers aid users in moving information between tangible and intangible mediums
- workspaces need to be able to accommodate the needs and preferences of both individual and group scenarios

These findings suggest that a group of workspace units with linked interfaces can offer users a supportive and conducive environment for creative work in the physical and digital mediums. This design concept offers a framework for a flexible information system that creates a unified environment of physical and virtual space for users to both interact and develop their ideas in a dynamic and integrated way.





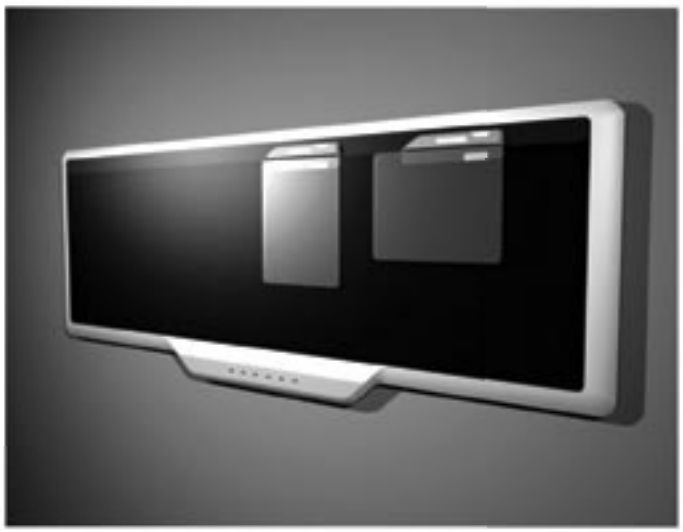


Table 19: Concept CAD Renderings

Conclusion

In conclusion of this thesis project investigation, I have found that the design and development of a creative workspace is essentially about supporting and enhancing the human user experience that takes place in the processing of information and the development of knowledge. Many of my conceptual explorations confirmed this idea in that the user activities and interactions ultimately defined the final form and embodiment of the workspace design. Whether planned intentionally or unintentionally in the design process, the user activities seem to be the primary component which progressively shapes the workspace environment.

By acknowledging the user's activities and interactions as a central component within the design of a creative workspace, my final designs represent a product system which includes the users as part of the combined solution. In a way, the various workstation units reflect individual qualities of the users themselves as they work both independently and in combination to form an interrelated system for developing new ideas.

Although my research involved a good bit of functional details regarding emerging technologies, it was primarily the user activities and human interactions which eventually served to define, shape, and add deeper meaning and value to the final design solution. My design process identified the different modes, phases, and situational contexts of user activities and group interactions and then simply explored various ways of building up structures in the physical and virtual workspace to support these experiences. In order to create a unified and connected information system within the workspace setting, I essentially tried to reflect the interrelated connections between the users and the flow of information within their creative process of exploration and development.

As an individual workspace can provide a very personal setting for people to think out and share their ideas, these workspaces are in a way reflective of their workers' needs, preferences, and thought processes. My designs attempted to build off of these aspects of private and shared spaces as well as notions of visual, spatial, or linear thought processes. The overall idea was to develop a comfortable environment that aids and encourages users to fluidly express their ideas and interact with others in a collaborative effort.

Ultimately, the technology behind the design solutions only serves to present the information to its users so that they themselves are able to do the creative work of transforming and evolving their ideas. Clearly, the technological components are intended to serve as the assistive aids as opposed to the creative source of the knowledge based work. The human user is the most critical component to the information system of the final design of the creative workspace in that they are able to ask the questions, analyze, and explore the information before them.

My final design for a creative workspace serves to connect the physical, virtual, and social aspects of information based work. There are three basic components within the workspace environment: the physical space, the virtual space, and the human users interacting within these combined workspaces.

For this solution to be applied successfully in a knowledge based economy, individuals and organizations must realize that a workspace setting can only offer a supporting structure whereas the innovation, creativity and the collective strengths must come from the individuals themselves who represent the true source of creativity, intelligence, and power of cooperative endeavors.

The final workspace design combines five structural elements providing a variety of capabilities and context sensitive support for users and groups engaged in collaborative work. Each design solution caters to a specific role within the product system. There are three stations which serve primarily as dedicated worksurfaces with support for both power and data port connections as well as integrated lighting for maintaining a built-in environment for the users. These three workspace stations offer users a range of customizable worksurface solutions that can serve the particular needs of their applications and activities within their creative process of developing new ideas. The other two additional workspace elements, provide more specialized displays, which further allow users to collectively explore, evolve, and communicate with each other throughout their creative process.

1

One of the worksurface solutions is a small, light-weight, trapezoidal worksurface which can be used to provide quick and convenient support as an impromptu setting for mobile workers in need of a tablet or laptop surface with power and data connections. These units include tabletops with 45 degree angled edges allowing them to be arranged in freeform clusters as well as linear or zig-zagging chains for group spaces. In addition, each unit provides a rear screen and overhanging canopy which can be modified or removed for each individual's needs and preferences. Other options include touchscreen PC displays mounted on the power and data strip at the rear of the desktop. The modification of each unit's customizable elements as well as the arrangement and orientation of each individual station allows users and groups to create workspace areas with varying levels of privacy and openness for group interactions.

2

The second worksurface solution serves primarily as a dedicated workspace optimized for both individual and group settings. With 90 degree sides and back surfaces, the stations can be efficiently arranged sided by side or back to back to form unified, group workstations for direct user interactions in collaborative work. These group arrangements act to create a continuous worksurface and display area for the needs of communication and exchange between a team of workers involved in the transformation of ideas. Each unit includes a rear shelf with an integrated power and data strip which can provide users with networked connections to each other and to the shared resources of the workspace environment.

The additional rear screens and overhanging canopies provide users with customizable features for privacy as well as display purposes. Whether as individual stations or as grouped clusters, the screened canopies and integrated overhead lighting serve to create a unified space for the users and their work.

3

The third worksurface solution provides for a workspace setting that creates more of a shared public space for users to develop and present their ideas. The worksurface has contoured edges that wrap around the front and side of the unit suggesting an invitation for users to pool around the work in progress or on display. With a flat back surface, these stations can be connected back to back to create an island type of configuration for users to engage in a group activity. The rear shelf with power and data connections as well as the overhead canopies and lighting would join to form an immediate, unified environment for users to express and evolve their ideas with others.

Each of the three variations of worksurface solutions utilizes a modular construction system which incorporates a frame structure formed out of aluminum rail extrusions that can be easily adjusted for height, fitted with added components such as shelving and storage, or modified with additional displays and pin-up surfaces. All three of the worksurface stations provide integrated power, data, and lighting and would be capable of supporting either mounted PC displays or mobile laptops and tablet PCs. Additional wireless peripherals could be used in conjunction with the data strips to connect to the users' digital computing environment.

4

The fourth workspace element serves primarily as a mobile, collaborative display board where users can explore, evolve, and express their ideas in a group setting. The large touchscreen display provides a natural and intuitive way of interacting with the information based content of the virtual space using multi-touch sensing technologies. This workspace element offers users a big picture overview of the combined work while serving as a mobile work and presentation space used in conjunction with lightweight workstations and laptops or tablet PCs. Additional features such as integrated data ports as well as a scanner and printer in the mobile display stand allow users to both input and output related information between physical and digital mediums. Further options for the collaborative display board's interface could also provide support for video conferencing technologies enabling networked communications and virtual teaming.

5

The fifth workspace solution serves as a networked display board that acts like a webspace communication site with a physical presence within the workspace environment. The wall mounted touchscreen display would present information posted over a network as well as content uploaded directly through its integrated data ports. Users could access, explore, and edit content either directly on screen or indirectly through a networked interface. The display board also includes detachable, light weight, flexible displays that would further allow users to edit and exchange information

through a more tangible smart document. These handheld hybrid displays would serve as a middle medium of the physical and digital content for users to easily view, share, edit, and transfer information between different users and locations within the combined workspace environment.

Together, these workspace elements form an interconnected product system in the final design for a creative workspace for physical and virtual information based work and experiences. As a group of design solutions, their flexibility and wide-ranging capabilities are multiplied through their combined applications. The result is a physical-virtual workspace environment that can organically evolve and dynamically adapt to the activities of its human users. Just as the combined workspace solutions function as an interrelated system, so do the human users. Together the creative workspace and its users form an organizational structure for exploring and transforming information and ideas for positive growth and mutual enrichment.

The Final Design in Application

My thesis project is titled *Physical-Virtual Workspaces* in that it seeks to improve the traditional workspace environment by creating a more integrated solution that effectively connects the physical space, the virtual space, and the human users interacting with each other within the combined physical-virtual workspace environment.

The following project scenario serves to illustrate the results of the final design in application in order to evaluate the advantages and disadvantages offered through the implementation of the final Physical-Virtual Workspace system design.

In a project to develop a new office task chair, there happens to be an associated group of designers and engineers working together on different aspects of the design and development work. From start to finish, there are a combination of research and development stages which require a fluid flow of information between physical and virtual mediums and between the team members themselves.

The Physical-Virtual Workspace System provides an improved workspace environment to effectively explore, develop, and communicate new ideas throughout the process of creative work.

The workspace system includes the following components:

Concept 1: the modular workstation

Concept 2: the lightweight workstation

Concept 3: the pavilion workstation

Concept 4: the collaborative display

Concept 5: the networked display

*The users

In the initial research phase, industrial designers Peter , Paul, and Mary need to explore, gather, and organize the reference information that will support their design and development work. This involves collecting information from various sources existing in both physical and digital mediums. The Physical-Virtual workspace components allow them to structure their thoughts and ideas within their immediate physical surroundings while also providing access to a virtual thought space as well.

disadvantage - many existing workspaces lack a balanced allocation of space between the physical and virtual mediums

advantage - The Physical-Virtual Workspace system provides support and connectivity for both the physical and virtual mediums of information and experience

Pros and Cons:

Although the combined physical-virtual workspace requires a certain amount of physical space and power support for the digital components, the benefit of being able to access virtual information throughout the creative process renders the inconvenience as a small sacrifice. For the most part, the digital-virtual component contributes more than it detracts from the overall qualities of the workspace.

The workstations in concepts 1, 2, and 3 serve both individual and group processes. This flexibility allows the team to develop initial ideas both individually and in small teams and then bring them together as a larger group for review. The networked connectivity of the workstations allows them to exchange digital content and communicate across wires, while the physical connectivity provided through the integrated power and data port connections and the ability to configure individual workstation units into linked chains or group clusters, allows for direct face to face human interaction and collaborative interactions between users. As modular units that also include options for overhead lighting from compact fluorescents or LED strip lighting, the workstation concepts allow users to easily configure a space to suit the specific needs of a project or type of group interaction.

disadvantage - many existing workstation concepts work primarily for individuals and do not accommodate collaborative work

advantage - The Physical-Virtual Workspace system includes workstations designed to work both as individual units as well as in group configurations which promote and support collaborative work and user interactions

disadvantage - many existing workspaces lack flexibility and options for user customization

advantages - The Physical-Virtual Workspace system uses a modular aluminum extrusion frame system which allows for various adjustments as well as many options for add-on components like additional panels, storage bins, filing cabinets, lighting options, etc.

Users can customize their immediate workspace environment to suit their particular needs and preferences with options like adjustable overhead lighting and user customizable back panels and privacy screens

Pros and Cons:

The structure and features of the modular frame system create a distinct aesthetic which may not meet the preferences of all users, but the advantage of easy adjustability and modular customization are likely to be of greater value to many organizations who must meet a larger range of user demands and preferences.

In terms of how the workstations can be clustered, there are inevitable complexities in creating and supporting the

desired types of interaction while still satisfying individual preferences for privacy and focus. When it comes to visibility and openness, there will always be a difference of opinion, but the ability to customize the types of open displays and levels of privacy screening between individual stations helps to accommodate a wider range of user preferences.

Peter can use a lightweight workstation as a temporary and convenient way to connect the mobile work of his laptop to the studio office environment. He has been collecting onsite data from various businesses and professional office environments regarding the user activities and preferences for seating. The lightweight workstation provides power and data ports for him to plug in and power his mobile pc and easily transfer his digital files through the high speed data ports to the local server. In addition, the integrated wireless usb hub allows anyone on the network to access components plugged into any one of the hubs. As a highly mobile worker he doesn't always work in the office, and therefore the lightweight workstation serves as a convenient landing pad or docking station when he visits the office. Peter occasionally uses one of the larger shared work stations in the office and often tends to use any available open space to work, but the lightweight workstations are convenient in that they can be easily moved about the office while still providing him with basic power and data connectivity.

disadvantage - existing workspaces often lack easily accessible connectivity to data and power interfaces which can obstruct the flow of information and a users work activities

advantage - The Physical-Virtual Workspace system provides workstations with integrated power, data, and lighting options that provide a self-contained infrastructure to support both physical and digital work

disadvantage - there are often few accommodations for mobile teleworkers in an office with dedicated office space for on-site workers

advantage - The Physical-Virtual Workspace system provides lightweight workstations for shorter periods of work and more mobile workers and activities

Pros and Cons:

The lightweight workstation is good at being light and mobile, but there are sacrifices in terms of the amount of physical workspace offered to the user. The small tabletop is optimized for laptops, tablet PCs, or wireless peripherals such as a keyboard and mouse to work in conjunction with a rear-mounted PC screen. The compact work surface is capable of offering limited support for paper and bookwork, but is not intended to serve as a dedicated workspace.

As an advantage of its compact size, the lightweight workstation can also be arranged and configured for varying levels of individual privacy or group interaction. The rear privacy screens mounted to the back of the units are removable and can be fitted with a range of materials to affect the amount of light which passes through and is reflected from the surfaces.

disadvantages - existing workspaces don't offer options for adjusting the levels of visibility and privacy within a space

advantages - The Physical-Virtual Workspace system offers workstations that allow for varying levels of screened privacy or openness

Pros and Cons:

The lightweight stations are fairly open and exposed to the surroundings and may not satisfy greater demands for individual privacy and focus. The rear screens are minimal and do not offer much room for display surfaces such as a pin-up board. This openness is best suited for collaboration versus isolated focus.

It is important to note that the angled edges of the lightweight worksurface are designed to maximize the range of possible configurations versus the amount of physical work area available within the immediate workspace. At the sacrifice of desktop space, there is a greater amount of flexibility in how the units can be arranged and configured.

Paul has been using one of the modular workstations as a more dedicated workspace. He has customized his workstation with dual displays that are fully adjustable on flexible arms which slide on the tracks of the modular extrusion frame system. The adjustable displays create a dynamic display of virtual information within the space and allow him to easily alter his workspace by shifting the displays to accommodate different types of work. One of these displays is actually a tablet PC which can be removed for more mobile activities. Paul uses his workstation for both physical and digital work. He is able to search the net for relevant information in seating technologies and easily compare this information with some of the sample materials he has within his physical space. The back panels of Paul's modular workstation include one side which functions as a pinup surface for notes and drawings, and another side filled with a translucent material to allow for more natural light and just the right amount of personal privacy. Paul uses the convenient electrical ports to power such tools as a digital camera and scanner which he uses to capture image references and scan fabric samples into the computer.

disadvantages - many existing workspaces only incorporate fixed displays

advantages - The Physical-Virtual Workspace system offers workstations with tablet PC displays mounted on adjustable arms that can also be removed for mobile work

disadvantages - many existing workspaces lack physical space to pin up paper documents or arrange physical objects

advantages - The Physical-Virtual Workspace system provides options for pin-up surfaces as well as physical worksurface area to store and arrange tangible content

Pros and Cons:

Although the vertical surfaces create somewhat of a wall around the workstation, they offer space for display surfaces like pin-up boards, marker boards, and hanging storage bins. One distinct advantage of the modular workstations is that in comparison to cubicle solutions which rely on a system of walled dividers to partition the space and route cabling for power and data, the modular workstations essentially integrate all dividing surfaces and supporting connectivity into the workstation itself. This allows each unit to be easily moved into the desired configuration with all of its primary infrastructure intact.

Paul's modular workstation is connected back-to-back with Mary's modular workstation which allows them to easily exchange information and ideas regarding their project. The openings through the back of their workstations allow them to easily pass interesting readings from magazine articles as well as shared tools and supplies. Mary uses the

back panel of her workstation to pin up various clippings and printouts from her work. Her display slides in front of her pinup surface, allowing her to arrange her thoughts on both physical and digital layers. Both Mary and Paul value the fact that they can control the lighting conditions within their immediate personal workspace to suit their particular activities and preferences.

disadvantages - the shared space requires a certain amount of cooperation between users as to how it should be used in terms of the amount of visibility and privacy versus the amount of area available for pin-up surfaces and digital displays

advantages - the modular framing system of the Physical-Virtual Workspace stations allow for varying levels of openness and privacy as well as options for creating alternative display surfaces

disadvantages - many workstations are skewed toward catering to either the physical or virtual workspace

advantage - in the workstations of The Physical-Virtual Workspace system, users can view and compose both tangible and virtual information within one workspace setting

Pros and Cons:

The fact that users can customize their space to suit there own needs and preferences ultimately requires a little give and take between users with connected units where the visibility and quality of one environment can be directly impacted by an adjacent unit. Opaque vertical surfaces like pin-up boards and even computer displays can impact the amount of visibility and natural light available to surrounding workstations. Once again, the flexibility offered by the modular design works to accommodate a cooperative balance.

When Paul and Mary need to work more closely in their conceptual development phase, they can easily reconfigure their workstation units in a side-to-side arrangement to form a more continuous worksurface between them. Because their overhead lighting and power and data port connections are fully integrated into their individual stations, the reconfiguration process is relatively easy and convenient, as all of their immediate infrastructure is retained within each modular unit. There is basically just one AC power cord to plug in for each unit. As a result, they can more directly share their thoughts and ideas and exchange information as they evolve their work. In addition to their digital content, their research clippings, articles, material samples, and rough sketches are arranged within their physical workspace to assist them in composing their culminating thoughts and ideas.

disadvantages - existing workspaces are not easily reconfigured to suit the changing needs of users and activities

advantages - The Physical-Virtual Workspace system provides workstations that can be easily reconfigured to suit the needs of various users and activities

advantages - The Physical-Virtual Workspace stations can form clustered group configurations to support collaborative work and user interactions

Pros and Cons:

Although the primary ports for power and data and the adjustable mounting arms for the PC displays are all integrated within each individual workstation, there is still one major power cord for each unit which needs to be connected for the supply of electricity. This requirement involves a certain amount of cable routing either down to the floor or up to the ceiling of the surrounding architecture.

Throughout the project, there are times when Peter, Paul and Mary use the lightweight workstations scattered around the office to huddle around a collaborative display to review their work as a group. The minimal lightweight workstations can be set up without their rear screen and canopies so that users can just use the compact worksurface with its integrated wireless usb hub and power ports for a notepad, sketchbook, or mobile PC. The individual units are relatively light and can be either slid or lifted by two people into the desired position or location. When necessary, wheeled casters can be added for greater ease of mobility. The designers often pool several lightweight workstations together in a fanned-out arrangement around the larger collaborative display which allows them to pull their individual work together as a group for analysis and review. The networked interface allows them to pull up and view the photo and video documentation of Peter's onsite research, the technical materials and manufacturing references collected by Paul, and also the concept sketches that are currently under way by Paul and Mary.

disadvantages - existing office spaces often do not offer spaces for collaborative work in both physical and virtual mediums

advantages - The Physical-Virtual Workspace system offers a collaborative display that works together with the other workstation concepts to provide both individual and group space

Pros and Cons:

The collaborative display is successful in providing a large display for group work and presentations, but there may be additional requirements for walled partitions to accommodate more private meetings. One key advantage of the collaborative display is that it is mobile and can be moved to any open space to create a place to meet and work as a group. As a large vertical surface, the display itself can be used to partition the surrounding space. Its placement and orientation can provide a certain amount of privacy, but some situations may require a more isolated space or closed room environment.

The group can easily reference the developments in each others joint work as they evolve their ideas together. The large touchscreen interface of the collaborative display allows them to explore, orient, and manipulate the digital content on screen as a group. They can use the display space to assemble their presentation materials and combine multiple forms of content from their joint work. The ability to work onscreen as a team, allows them to execute their individual ideas more successfully as a group. The multi-touch input technologies of the collaborative display screen enable them to simultaneously interact with the on-screen interface during their review process. The display interface allows them to easily make notes and document their design changes for future reference.

disadvantages - existing solutions often lack the ability to display virtual content on a large display with the ability for multiple users to interact with the screen based interface

advantages - The Physical-Virtual Workspace system offers a collaborative display with an intuitive touch-screen interface which accepts multi-touch inputs for simultaneous user interactions with the virtual content

Pros and Cons:

The ability to simultaneously interact with the onscreen content and controls creates a greater sense of freedom and openness among groups as they evolve their ideas, but obviously requires a certain amount of respectful consideration between users for each others individual works and ideas as in an open discussion.

The integrated multi-document scanner and printer allow them to easily transfer related information between both hard and soft mediums of physical and virtual formats. Paul's and Mary's sketches can be quickly scanned into the collaborative display interface for further development and review. Additional options for the collaborative display utilize an integrated webcam for creating a communications interface where the group can use video conferencing to speak with their clients, manufacturers, vendors, and other virtual team members. The collaborative display allows them to view and discuss their ideas with both local users and those connected via the net.

disadvantage - many existing workspace solutions lack the ability to hold group meetings locally and across the web while also providing space for both physical and virtual work

advantage - The Physical-Virtual Workspace system allows users, both locally and across a network, to view shared content and communicate through one integrated interface

Pros and Cons:

Working wirelessly across a network has its advantages, but so does face to face physical interaction among group members. Networked webcam conferencing with clients in Asia has its obvious advantages for saving time and travel costs, but there is also a great value in being able to communicate directly with team members while reviewing something like a physical, three-dimensional prototype that cannot actually be touched and experienced over the net. The networked interface of the collaborative display seeks to offer options for both physical and virtual mediums of information and experience so users can choose the form that best suits their application or scenario.

Information exchanged over the networked connection can be conveniently printed out through the integrated printer housed in the base of the collaborative display. Additional usb ports on the front of the display also provide additional means for the input or output of information using devices such as compact flash drives.

disadvantages - existing workspace solutions lack the ability to conveniently move information between physical and virtual mediums

advantage - the collaborative display allows users to easily move information between tangible and intangible forms by incorporating a multi-document scanner and printer as well as usb data ports for transferring digital information

Pros and Cons:

The ability to scan in or print out information to and from the collaborative display interface improves the flow of information and ideas between the physical and virtual mediums, but requires some maintenance for components such as printer media.

As the collaborative display is a mobile unit on casters, it can be quickly and easily positioned within almost any office or studio environment to provide a group meeting, communication, or presentation space. By integrating multiple technologies such as web conferencing and networked connectivity, convenient access to scanning and printing, and points for direct input and output through usb data ports, the collaborative display serves to unite both the work and the workers as they evolve new ideas.

disadvantages - existing solutions like projection systems often require additional reflective surfaces to project onto as well as low lighting conditions to view the projected content

advantages - the collaborative display is self-contained as a light emitting display and can be easily moved about with just one power cord connection

Pros and Cons:

Although the large emissive display can work in both light and dark environments without the need for a projection surface, there is an expected higher cost for such a large touch-screen interface.

When the designers start to work more closely with their engineering team members Jan and Bob, the Physical-Virtual Workspace system serves to connect their two specialized groups. Workspace components such as the networked display board serve as a virtual website with a physical presence within their shared office studio. Project updates can be posted over the net or uploaded directly through the usb data ports and the touchscreen interface. Announcements for upcoming meetings, special events, and items such as critical design requirements can be posted on the display in near real-time as the project evolves. The networked display has been positioned by the office water cooler and coffee machine to maximize its visibility and effectiveness in keeping the team up to date with the groups activities.

disadvantage - traditional office boards cannot be updated with dynamic content over the net

advantage - the networked display allows users to post, view, and edit dynamic content either over a networked connection or directly through the touch screen interface and the usb ports

advantage - compared to a fully digital alternative like a website message board or blog, the networked display board can serve both virtual and physical functions in keeping people connected and encouraging human interaction

Pros and Cons:

The networked display functions as a web-enabled interface that connects users in both the virtual and physical workspace. Users in the immediate office environment who may not be connected to an online discussion can still be connected to the news and events of their networked teammates. As users in the office space gather around the networked display, they may stumble upon a chance interaction with other teammates that can create stimulation for innovation.

Jan has opted to post a copy of the email she received from their parts supplier so that others in the office can view and respond to the details and referenced illustrations. Even though Peter missed the email, he was able to view the post on the networked display during a lunch break in the office. At the same time, he also noted Mary's post about a scheduled concept review in the following week.

disadvantage - current systems of communication do not link email and office message boards

advantage - the networked display board serves to connect the digital and physical forms of communication and interaction between team members

Pros and Cons:

As an overlapping system of communication and interaction, the networked display board would likely require some customizable levels of user controlled preferences to control the ability of other users and groups to view, access, and edit the associated content such as email and messaging.

The additional smart documents which work with the networked display board use flash memory enabled spines to store information for the flexible displays, allowing users to quickly view, edit, and share information in a more tangible way. The usb connection contained in the spines of the smart documents can be plugged into the front of the networked display board to quickly upload or download digital content. Although this type of connection could be handled wirelessly via a Wi-Fi connection or possibly through a Bluetooth connection, these options would likely increase the power requirements for the handheld displays. As an alternative, the displays could use technologies such as E-paper to further reduce power consumption and allow for a longer period of use between charges.

disadvantages - existing solutions lack tangible means of viewing digital content

advantages - the smart displays enable dynamic digital content to be both viewed and edited through the flexible handheld displays

Pros and Cons:

The smart document displays could reduce the amount of waste involved with the “one-time printout, read, and discards”, but would likely require a rechargeable power source to display and edit the digital content. In relation to the networked display, a similar system of user rights might also be required to manage the control of editable documents and content. One of the negative consequences of this system may be the very lack of a lasting, tangible artifact- especially when the digital version is no longer available or accessible.

For instance, printed matter like books and magazines do not require a powered display, a computing interface, or a particular software program to view their content.

Bob uses the networked display board and the capabilities of the smart documents to post and disseminate his findings regarding the technical specifications of manufacturing and construction options for the developing task chair concepts. Since they work in different areas of the building, the design and engineering departments aren’t always aware of the current activities of each other’s group. The networked display board serves as a physical location in their space for current news updates with the ability to transfer information through networked locations. To promote greater visibility within the office, the networked display board has been located in a high traffic area where most users are likely to pass by at least twice a day. Various activities and findings can be recorded, posted, and viewed to keep the team members up to date on the developing project work.

Paul noticed the posted information regarding Bob’s findings on the technical specifications and manufacturing options, so he decided to quickly download the pdf file to a smart document so that he could read it over a late afternoon coffee break. After reading the files and adding some notes regarding their design concepts, he decided to pass the smart document on to Mary who was evaluating some 3D scale models at her desk.

disadvantage - paper documents are often printed out for a one time read and then discarded

advantage - the smart displays enable users to view, edit, and then easily update the dynamic content, easily serving as a tangible middle medium between physical and digital

Pros and Cons:

The smart document displays promote the flow of information and ideas as well as the physical interaction of human users. There are additional requirements for the dynamic display of digital content, but the information can be edited and updated without the waste of paper and ink.

When Jan and Peter require a face-to-face meeting to review their work and the physical prototypes of their adjustable seat concepts, they prefer to use the open pavilion workstation since it offers more physical workspace for two or more members. The pavilion allows them to gather around a large display to work out some of the technical details in their preliminary CAD models and provides ample physical workspace to test the function and assembly of their prototype mechanism. Jan can easily plug a wireless keyboard and mouse into the wireless usb hub to connect to the PC display while Peter uses the power outlets to connect a video camera in order to record and document the process.

disadvantage - many existing workspace solutions do not accommodate multiple users with both physical and virtual space

advantage - the pavilion workstation accommodates multiple users with ample physical space and connectivity for accessing digital resources and virtual content

Pros and Cons:

The pavilion workstations offer a larger workspace for multiple users, but there may be a lack of personal connection without a sense of private, individual space.

Within the office space, there is a second cluster of pavilion workstations that are arranged back-to-back to form an island station. This workspace area is often used by people looking for an impromptu spot to quickly meet or review work on the displays or within the physical workspace. The rounded contours of the combined worksurfaces act to invite users into the information experience. The overhead canopy and integrated lighting offer a sense of privacy and serve to form a more unified space for a small group of users to collectively review both virtual and physical work. The group often uses this space to show off three dimensional models of their progress along with a slide presentation of the development work.

disadvantage - many existing workspaces do not provide accommodation for both work and presentation space

advantage - the island configuration of the pavilion workstations easily serves two to three people for joint collaboration and also functions as presentation space for small group meetings

Pros and Cons:

The pavilion workstation can be optimized as a work and presentation space by incorporating both physical pin-up space as well as dual displays. The larger worksurface area can also be raised to more of a bar height to be more inviting to non-seated attendees. However, in comparison to the smaller workstations, the pavilions require more physical space within a studio environment which may be an issue where size is a critical constraint.

During the development phase, Peter and Jan decided to move into the island pavilion to work through the details of their adjustable seating mechanism. The pavilion workstation provides a balance of connectivity, visibility, and separation for focused work. The integrated wireless usb ports allow them to share each others connected resources, and the open area between the two workstations allows them to make convenient exchanges.

disadvantage - many existing workspace solutions are closed off and separated by divided cubicle walls

advantage - the clustered pavilion workstations still allow for open areas enabling varying levels of visibility, privacy and exchange

advantage - the networked wireless usb hubs allow users to share plugged in resources across the network

Pros and Cons:

Shared space involves both benefits and sacrifices for multiple users to work together successfully. The benefits include the increased opportunity to exchange thoughts and ideas, the ability to maximize the effective use of limited resources, and the creative productivity of collaborative work. The sacrifices can include a lack of personal privacy and distraction-free focus and limitations on individual user customization.

Results

Through the extended office network, the combined team of designers and engineers, as well as those outside of their office who function as virtual team members, are brought together through the improved connectivity and integration provided by the Physical-Virtual Workspace system components.

Ultimately, the range of workstations as well as the collaborative display and networked display board offer a flexible and scalable system for organizations to create a supportive workspace environment to meet the specific needs of their diverse individuals, groups, and activities.

In the same way that these multiple workspace solutions act together to offer more diverse capabilities and opportunities, the collective efforts and interactions of human users are similar in that they can exponentially increase the power of our creative intelligence. The final design seeks to reflect these strengths and benefits of an interrelated system of combined elements whose synthesized whole is greater than the sum of its individual parts.

As the key element for creative intelligence and innovation, the user group itself is central to the successful application of the various resources of this creative workspace concept. By strategically balancing and arranging an appropriate combination of these workspace elements, organizations and individuals can develop customized workspace environments that can effectively support and enhance the activities, interactions, and creative output of its collective members.

In essence, the creative workspace serves to develop the human interactions involved in the creative exploration and development of new ideas. By helping users to connect the meaning of their ideas in both the tangible and intangible mediums, the physical-virtual workspace acts to knit together the different mediums of information and user experience. As humans interact within the workspace environment, they share their thoughts and ideas, but they also share an interactive experience as well. In this way, the building of knowledge develops as a result of both shared ideas and shared experiences.

In the end, the workspace itself becomes secondary to the knowledge generated through shared human interaction and experience.

Physical-Virtual Workspaces

Rochester Institute of Technology
Graduate Industrial Design
Samuel Breneman
MFA Industrial Design Thesis
Physical-Virtual Workspaces
Design Process Documentation
2.25.08

Thesis Timeline

Design for a Physical-Virtual Workspace

Research

Information Systems/Structures/Mediums

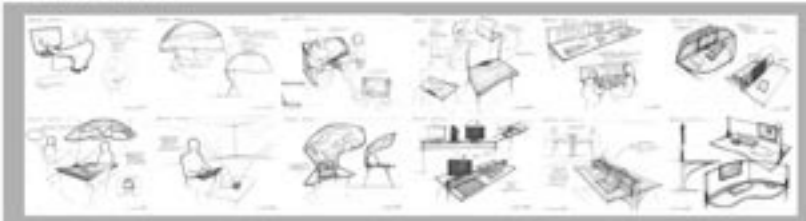
Market Reference

Workspace Analysis

Connecting Physical and Virtual mediums

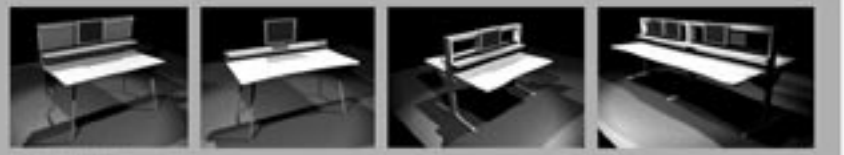
From a product design standpoint, we are encountering demands for solutions that exist between hard and soft mediums, and there is a need for workspaces that can support and connect both the physical and virtual development of such ideas. These hybrid products are bridging a gap between our physical and virtual experiences and creating new challenges as well as new solutions. In essence, they are serving to connect the tangible and the intangible aspects of our lives.

Concept Exploration

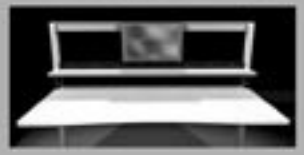


Concept Sketches

Design Development



Concept Modeling

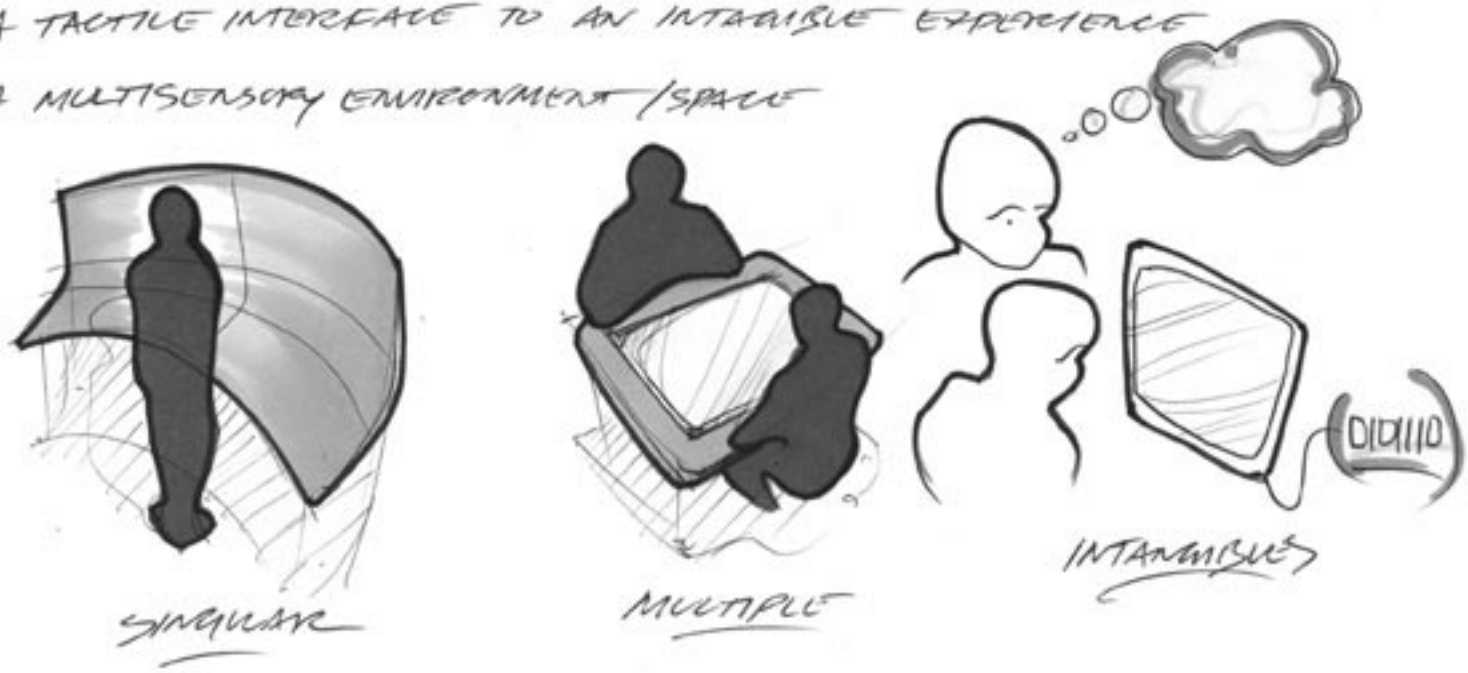


My thesis is focused on the connection between the physical and virtual mediums of information and experience. I hope to explore the workspace as a stage for composing such creative content that includes aspects which are both tangible and intangible. The design explorations will consider the balanced relationship of user experience and social interaction within the working space where intangible ideas are transformed into a tangible reality.

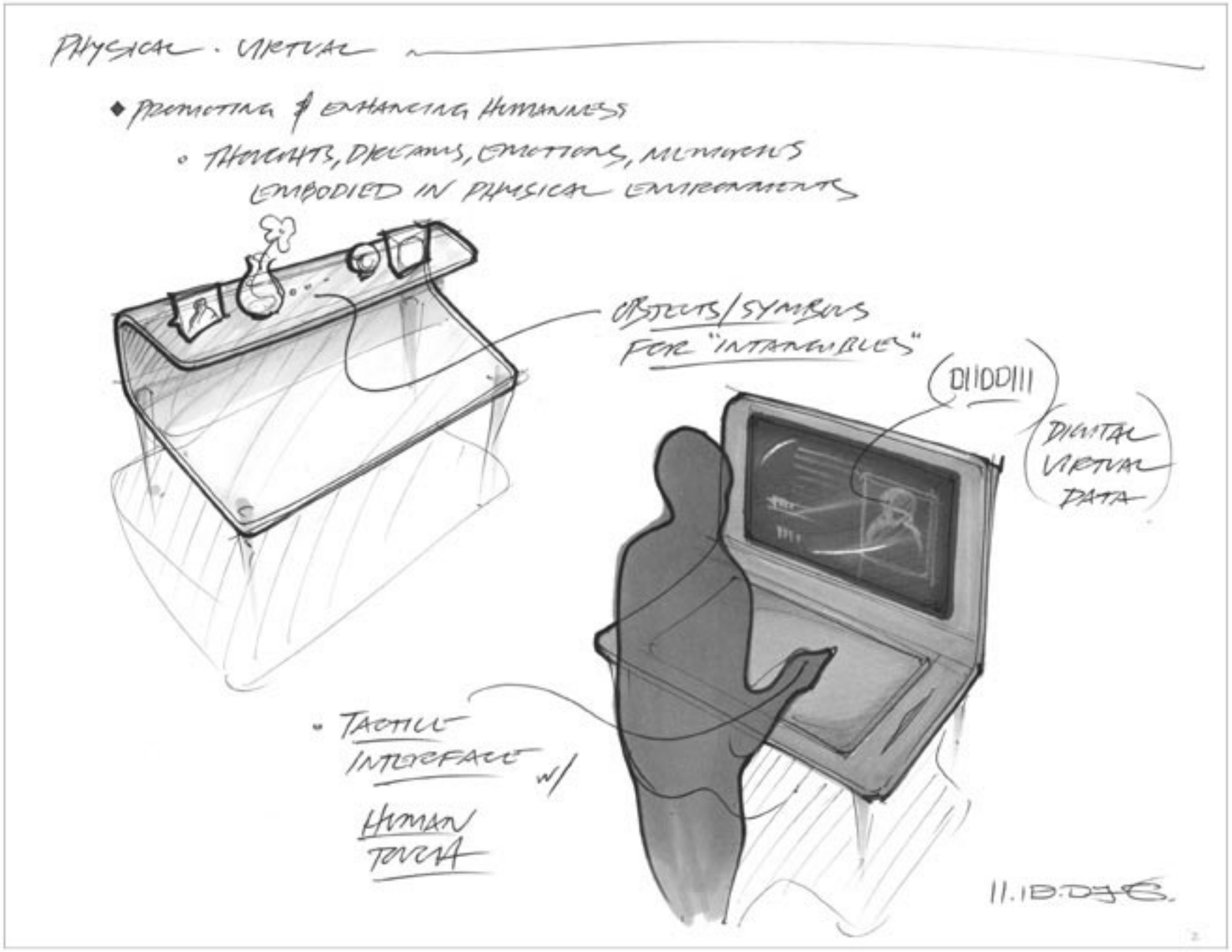
The goal is to develop a creative workspace that can be used to form and develop new ideas. The supportive stage would provide the space and means for accessing and manipulating both physical and virtual content serving as an integrated interface allowing users the ability to fluidly express their ideas in both digital and material mediums.

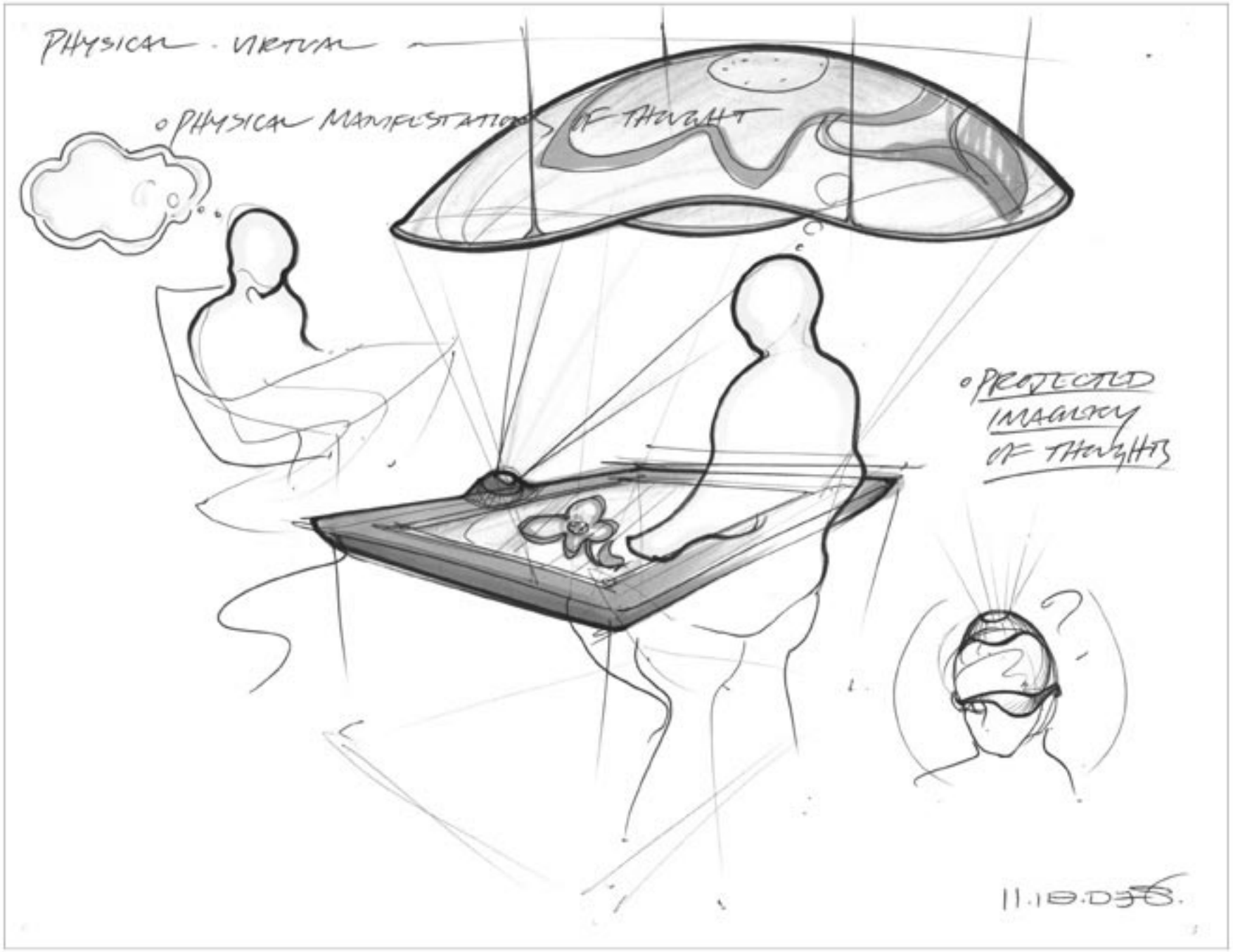
PHYSICAL · VIRTUAL

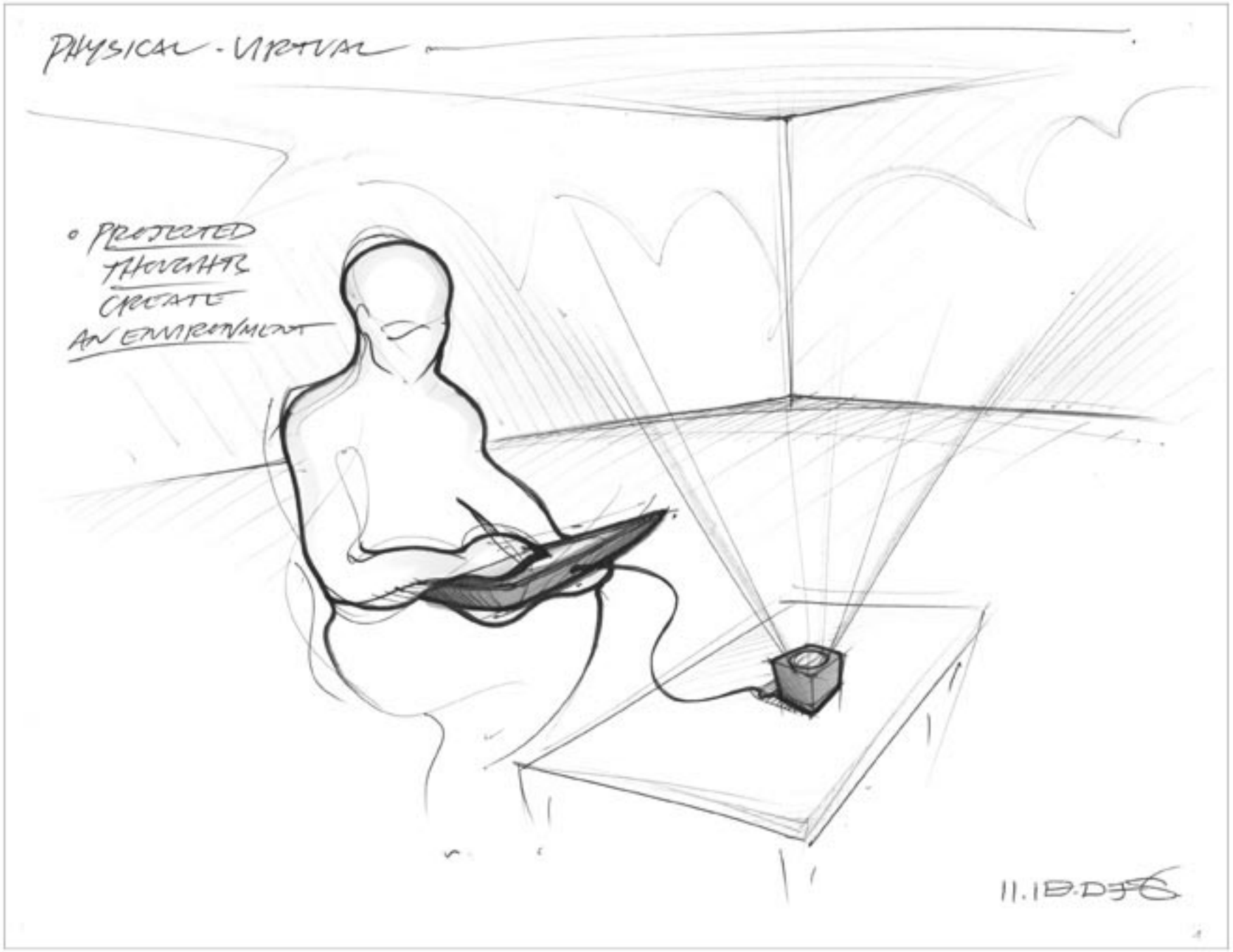
- PROMOTING – CELEBRATING HUMANNESS IN THE INTEGRATION OF TECHNOLOGY...
  - PHYSICAL OBJECTS OR ENVIRONMENTS THAT CONNECT TO VIRTUAL/INTANGIBLE EXPERIENCES
  - A PHYSICAL · VIRTUAL WORKSPACE
  - A TACTILE INTERFACE TO AN INTANGIBLE EXPERIENCE
  - A MULTISENSORY ENVIRONMENT/SPACE

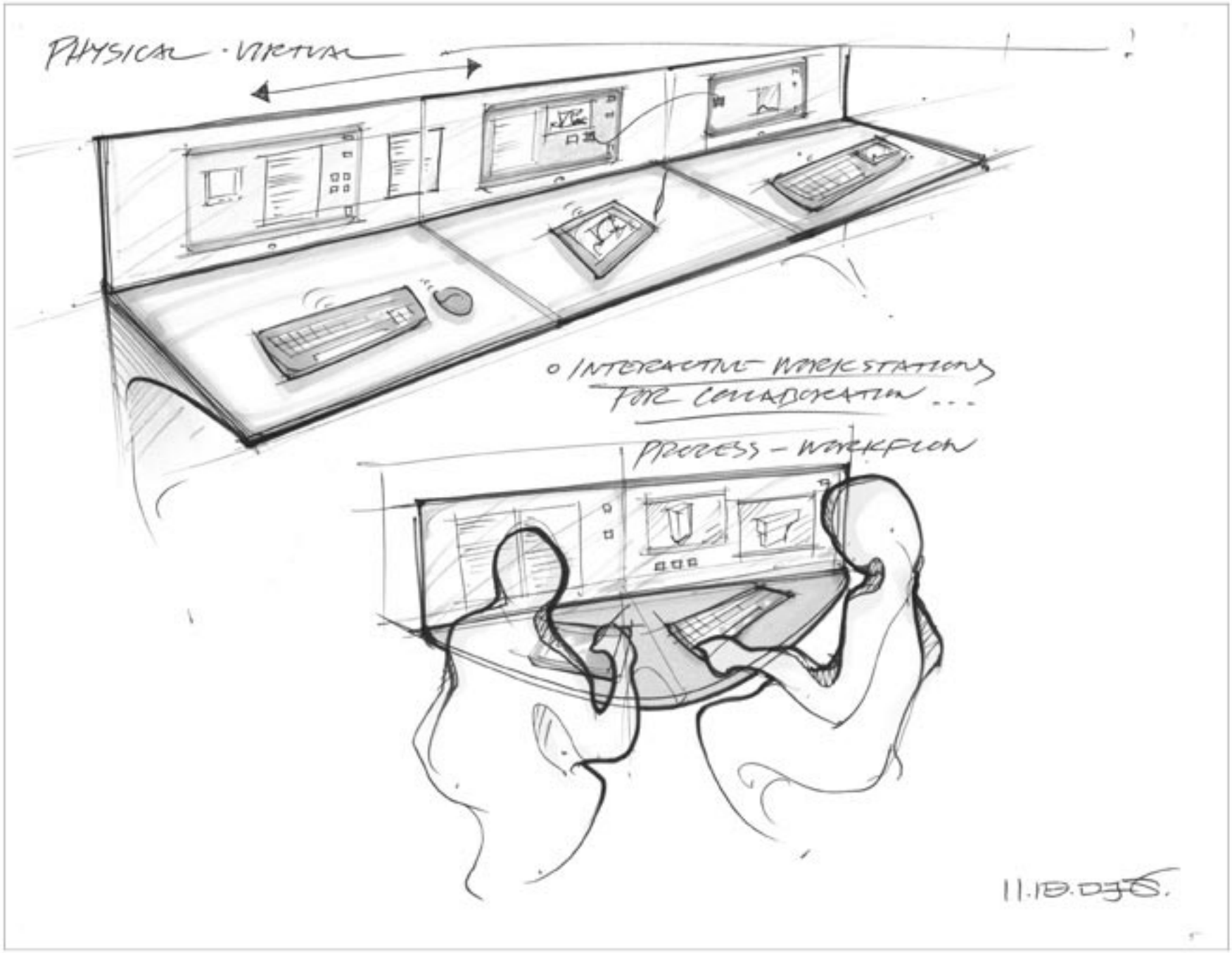


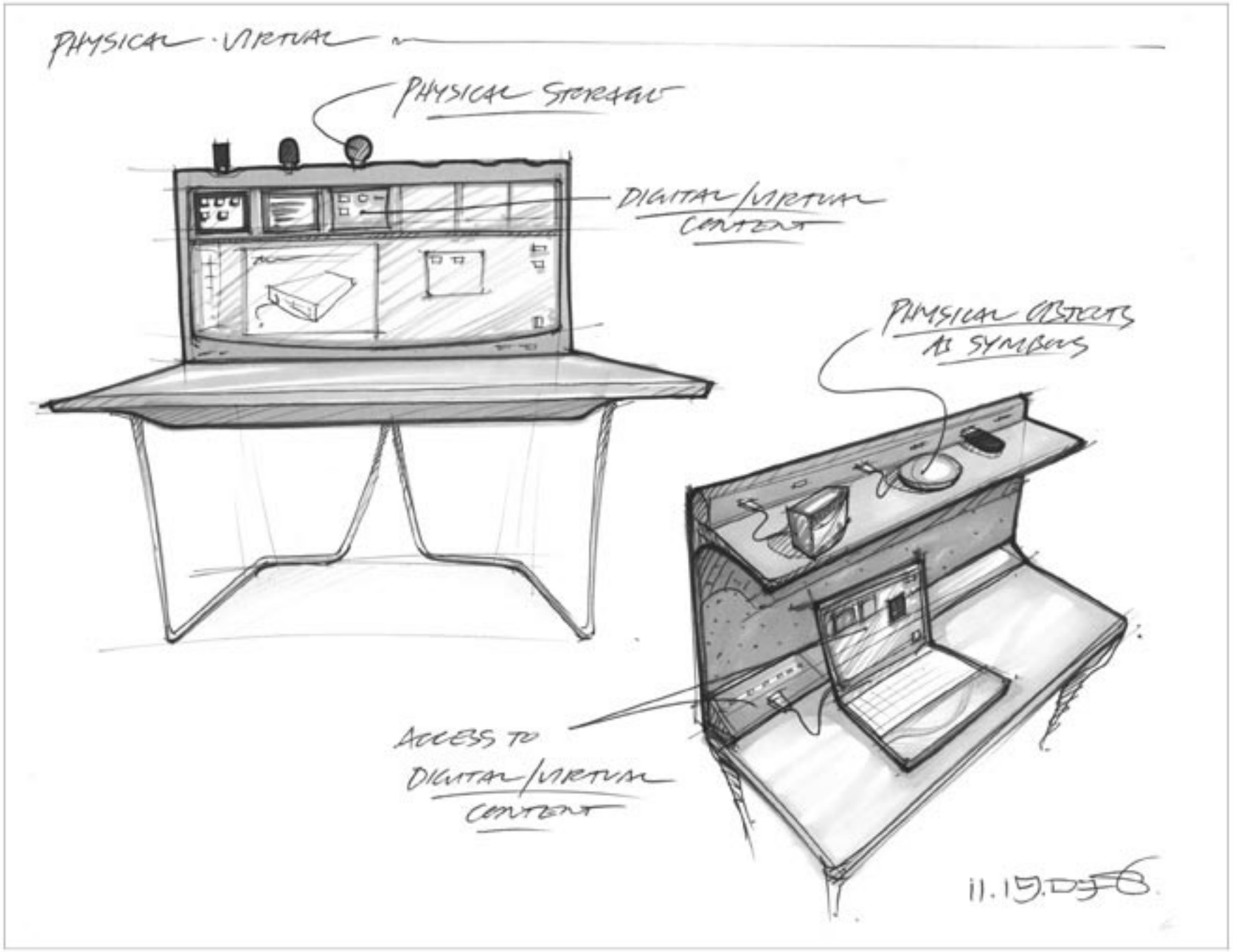
11.19.05.

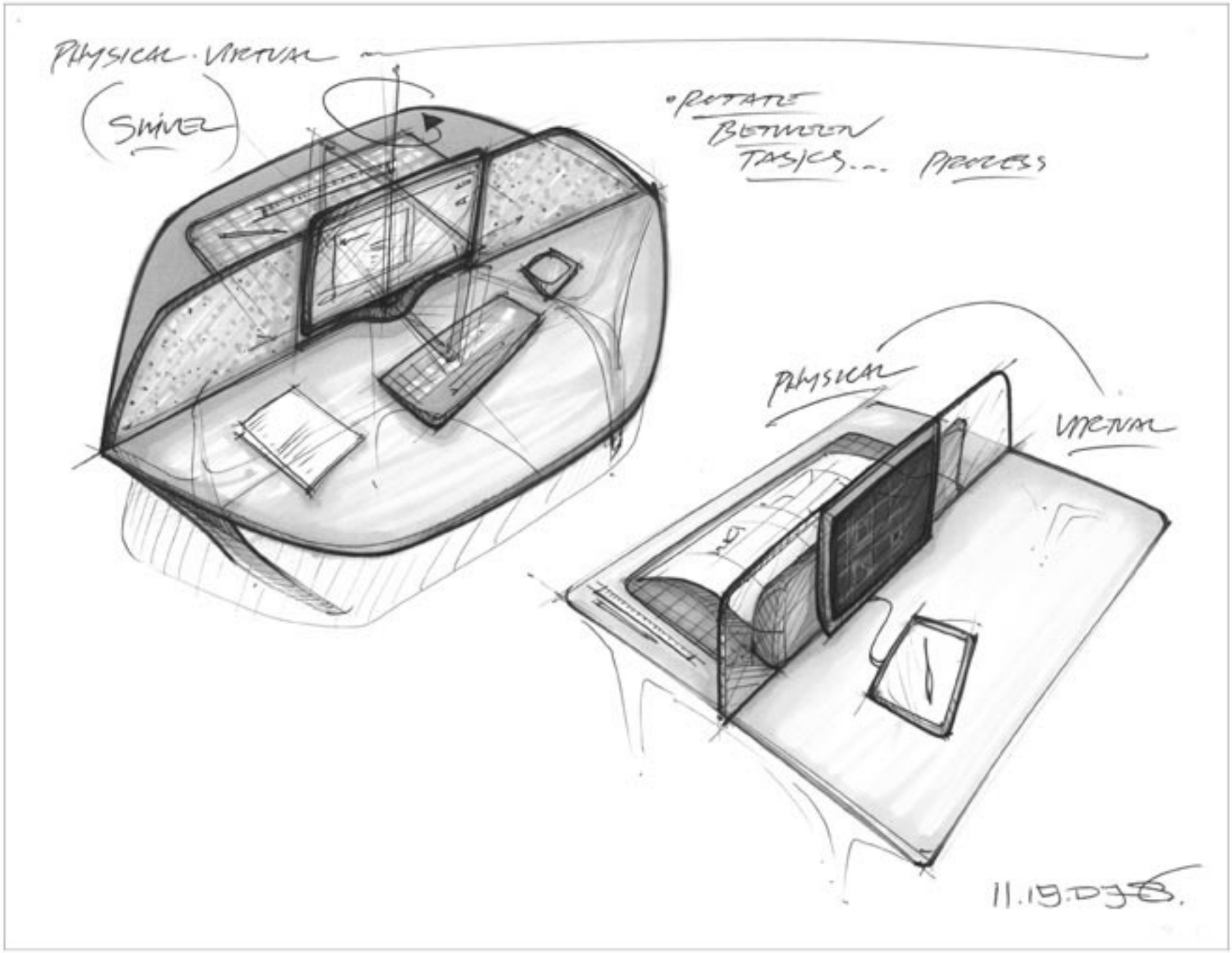

PHYSICAL · VIRTUAL
◆ PROMOTING & ENHANCING HUMANNESS
○ THOUGHTS, DREAMS, EMOTIONS, MEMORIES EMBODIED IN PHYSICAL ENVIRONMENTS
OBJECTS/SYMBOLS FOR "INTANGIBLES"
DIGITAL VIRTUAL DATA
• TACTILE INTERFACE W/ HUMAN TOUCH
11.18.95


PHYSICAL - VIRTUAL
o PHYSICAL MANIFESTATIONS OF THOUGHT
o PROJECTED IMAGERY OF THOUGHTS
11.18.06.

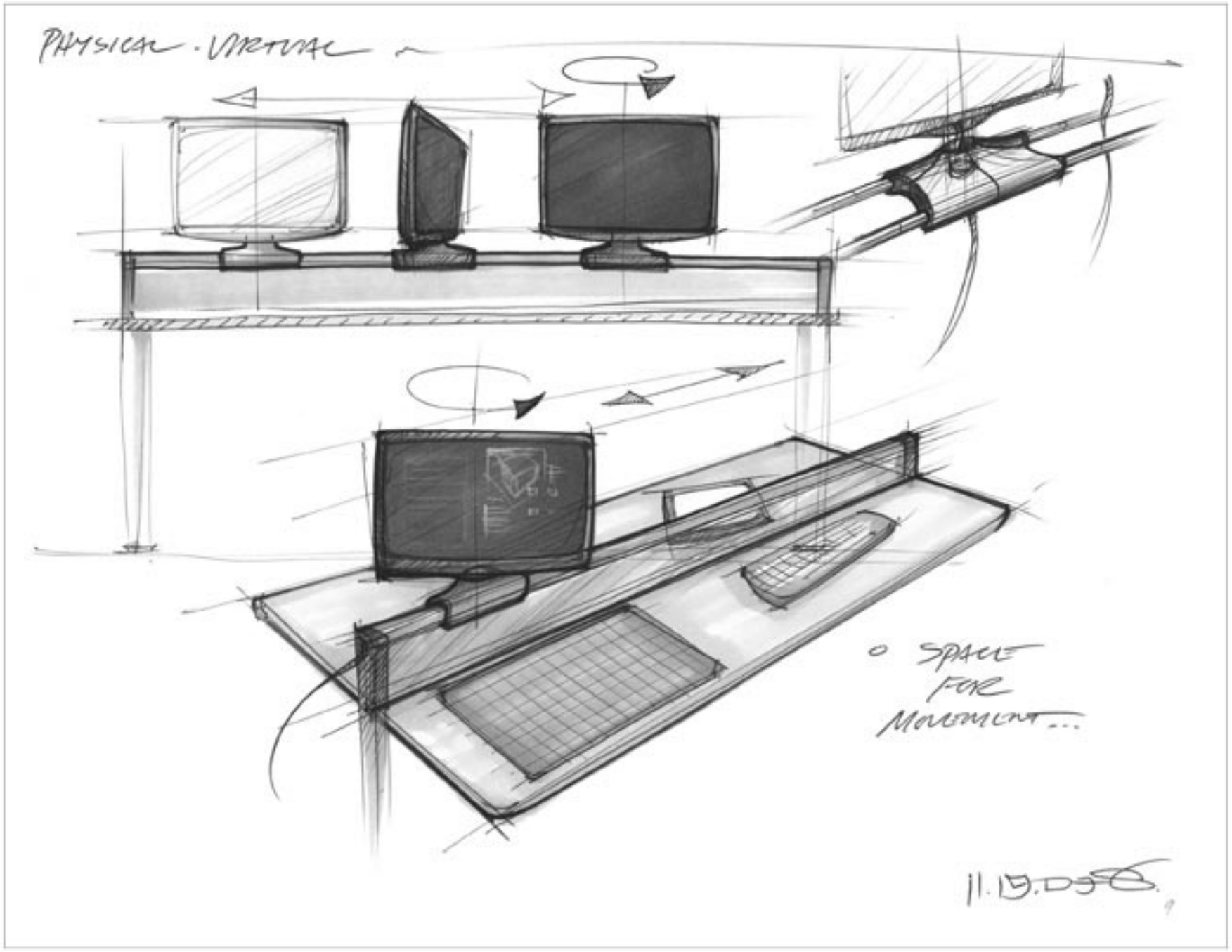

PHYSICAL - VIRTUAL
• PROJECTED THOUGHTS CREATE AN ENVIRONMENT

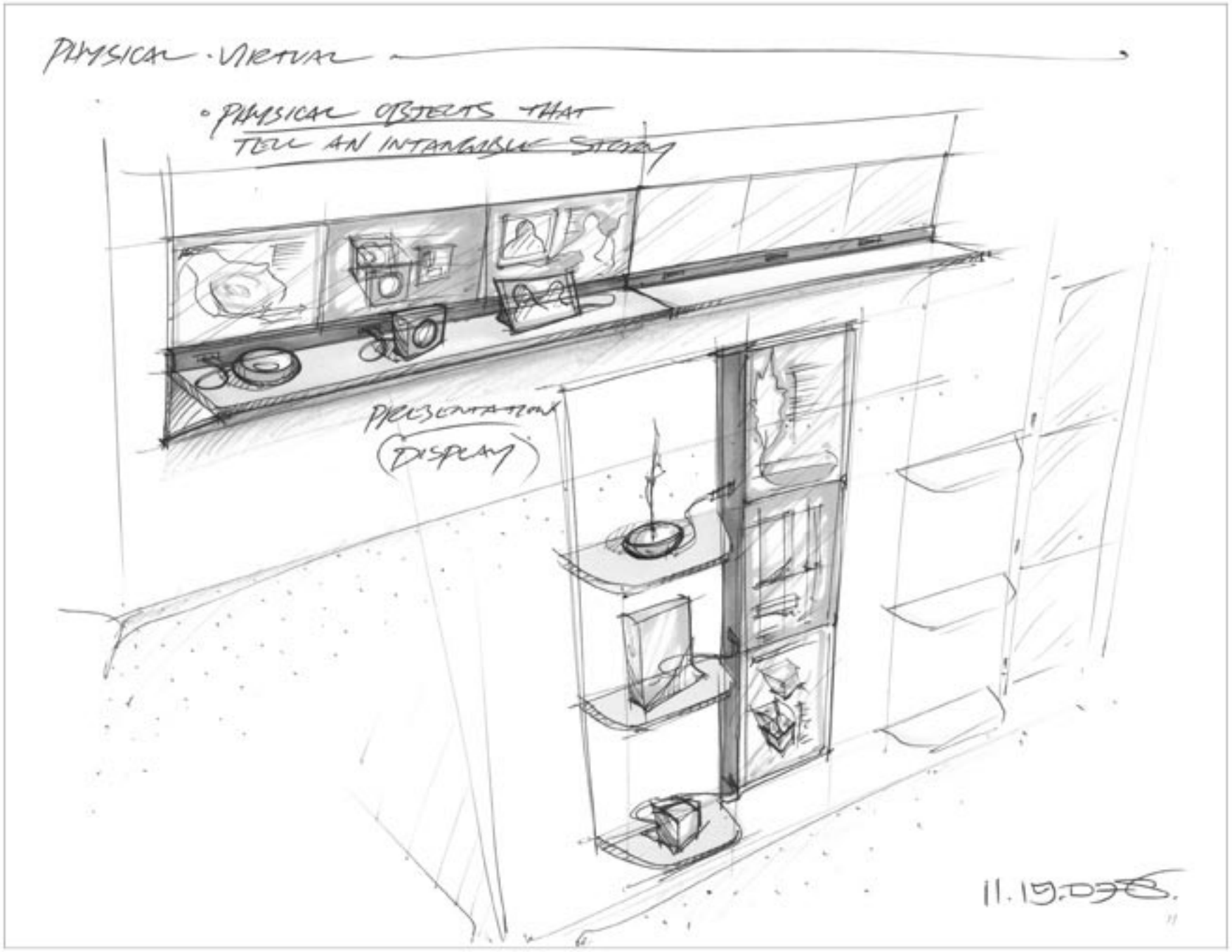

PHYSICAL - VIRTUAL
o INTERACTIVE WORKSTATIONS FOR COLLABORATION...
PROCESS - WORKFLOW
11.19.05

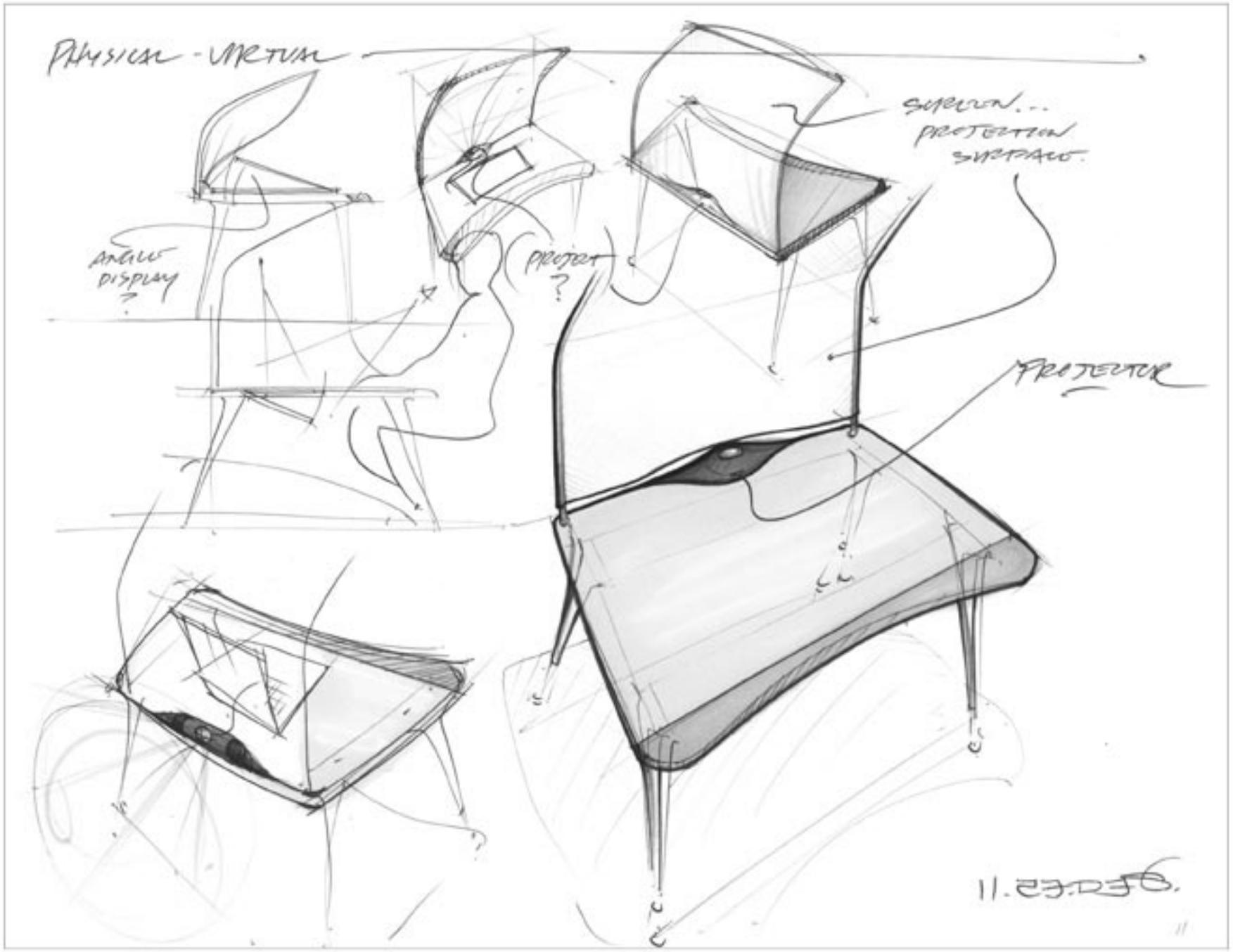

PHYSICAL · VIRTUAL
PHYSICAL STORAGE
DIGITAL/VIRTUAL CONTENT
PHYSICAL OBJECTS AS SYMBOLS
ACCESS TO DIGITAL/VIRTUAL CONTENT
11.17.06

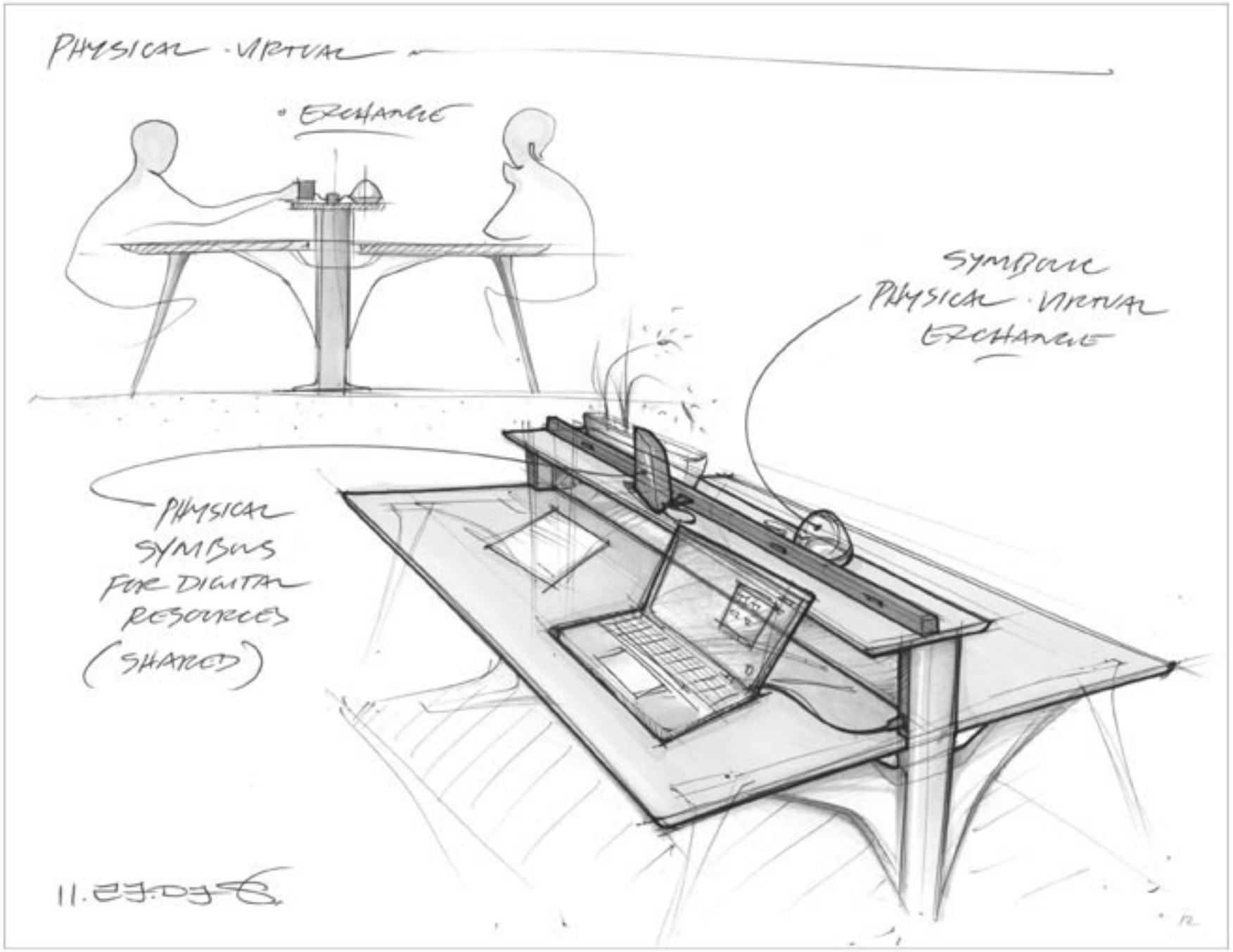

PHYSICAL · VIRTUAL
SWIVEL
• ROTATE BETWEEN TASKS... PROCESS
PHYSICAL
VIRTUAL
11.19.08


PHYSICAL · VIRTUAL
• A PROTECTED ENVIRONMENT
11.19.05

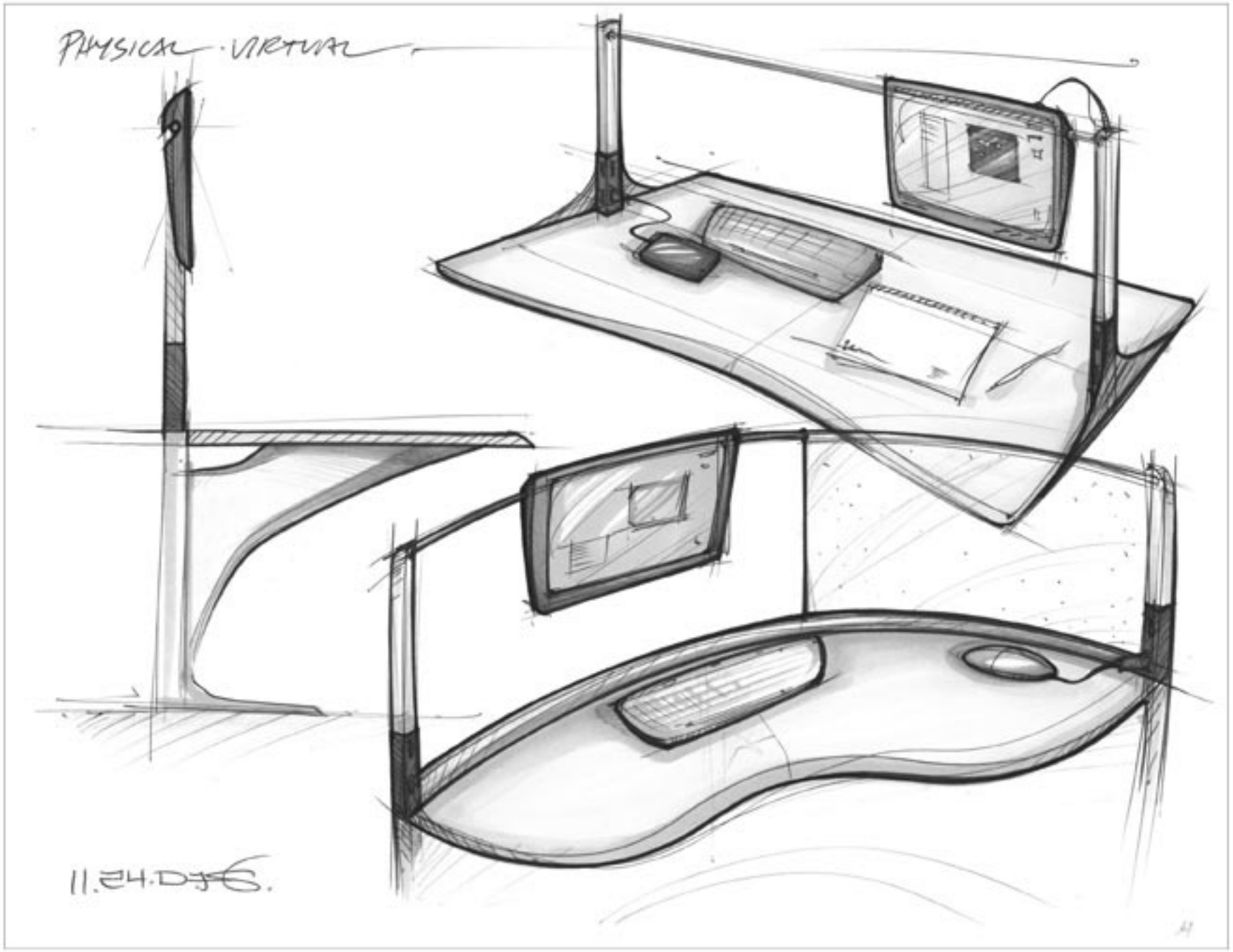

PHYSICAL · VIRTUAL
SPACE FOR MOVEMENT...
11.19.05

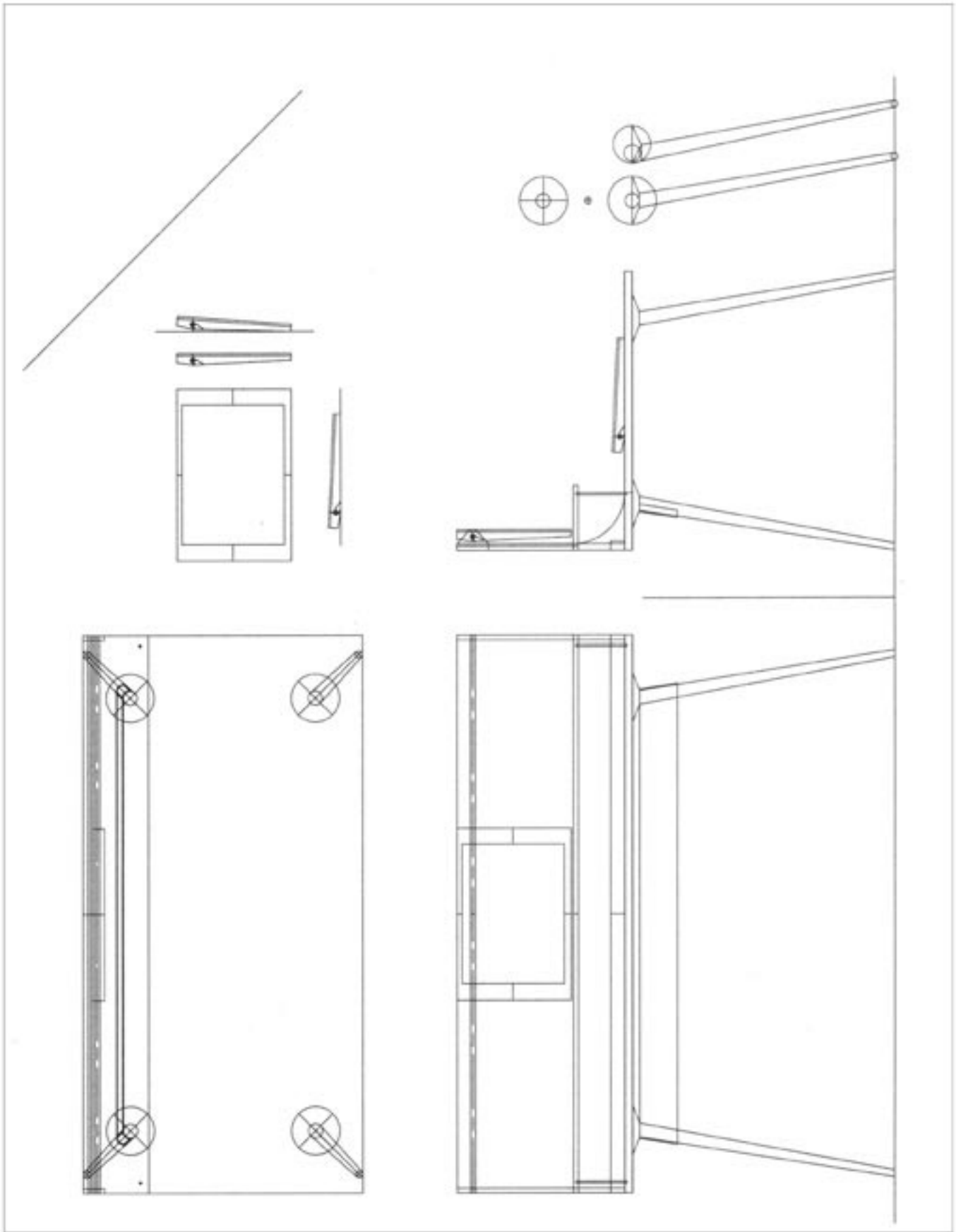

PHYSICAL · VIRTUAL
• PHYSICAL OBJECTS THAT TELL AN INTANGIBLE STORY
PRESENTATION (DISPLAY)
11.19.05

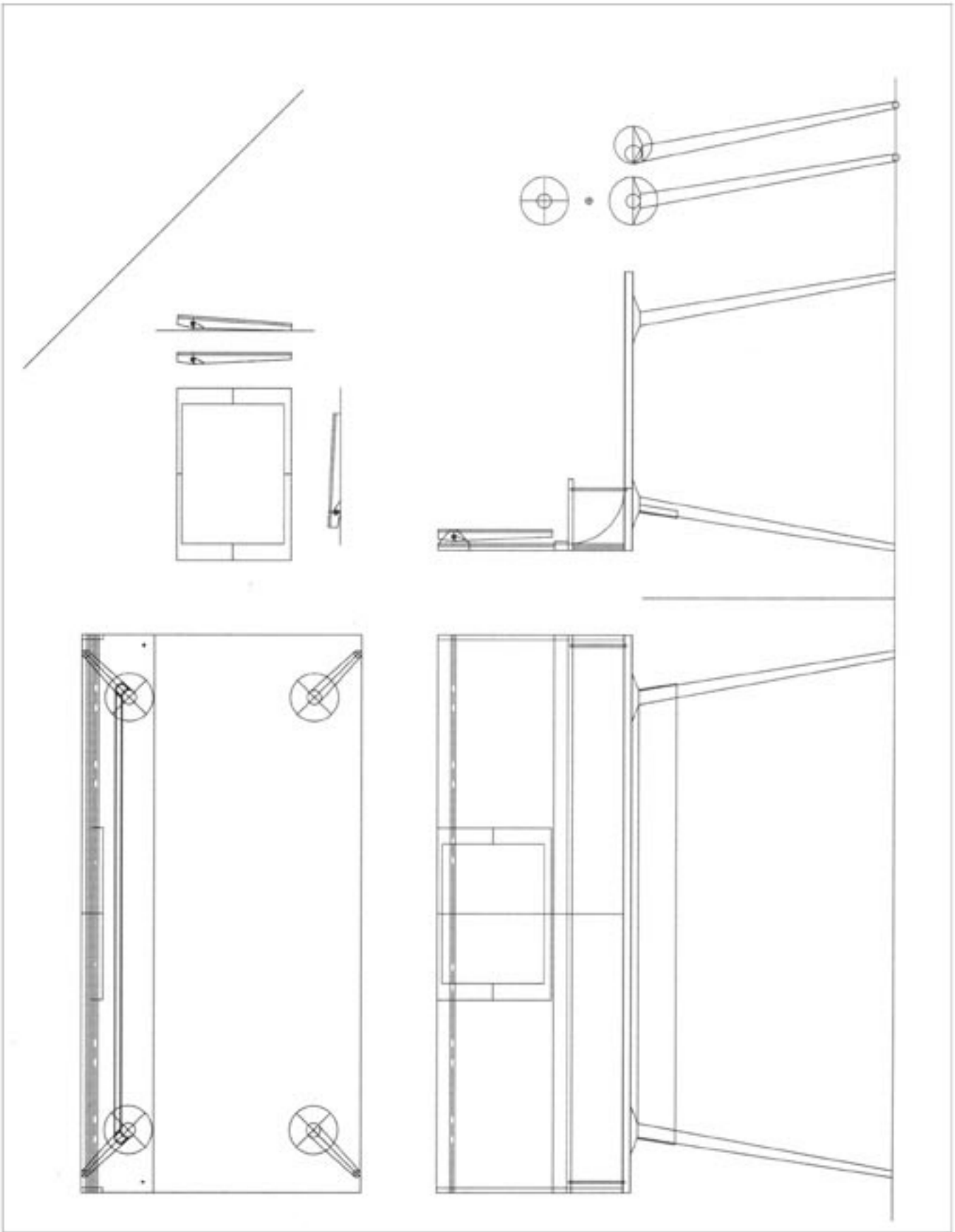

PHYSICAL - VIRTUAL
SURFACE...
PROTECTION
SURFACE.
ANGLE
DISPLAY
PROJECT
?
PROJECTOR

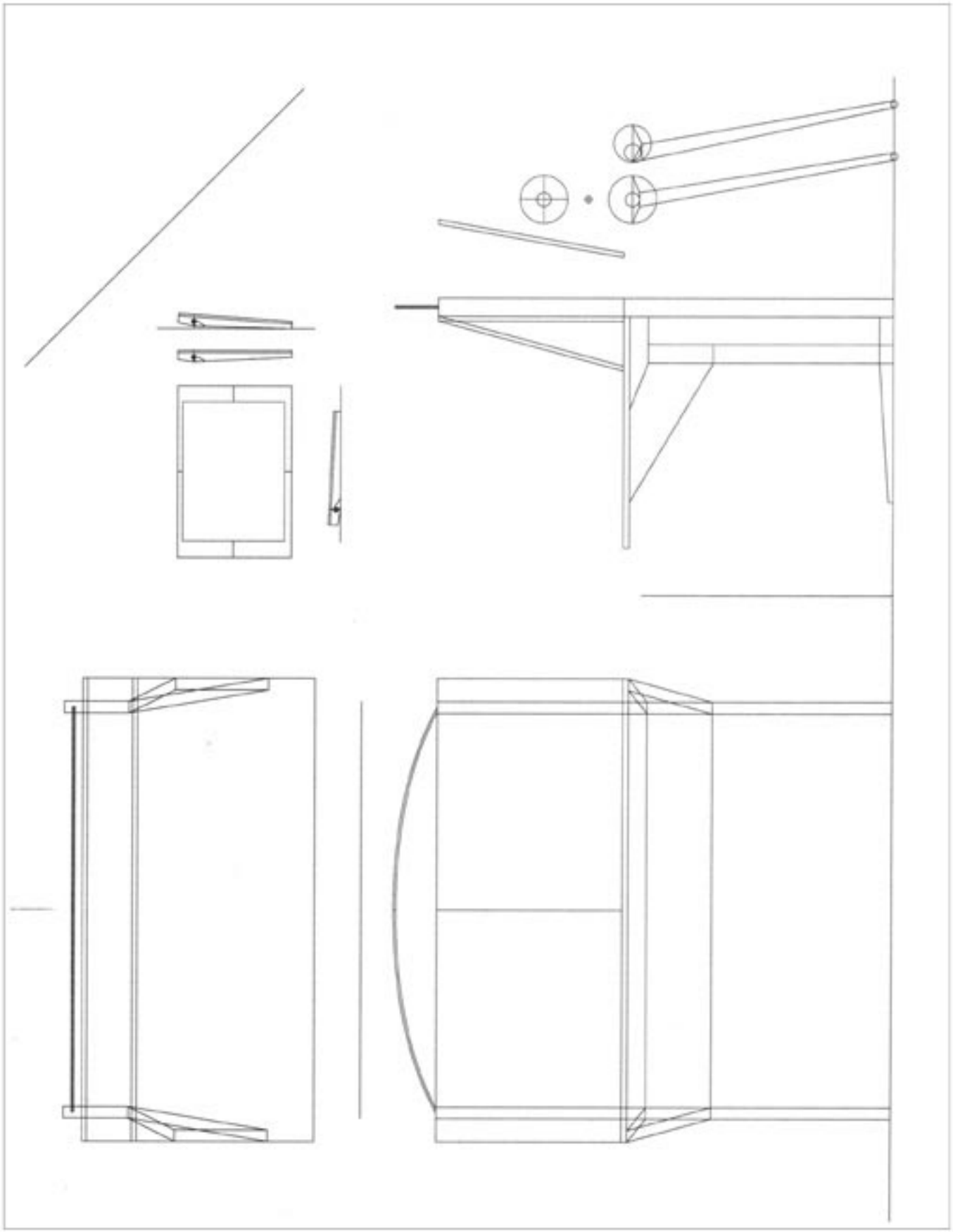

PHYSICAL · VIRTUAL
· EXCHANGE
SYMBOLS
PHYSICAL · VIRTUAL
EXCHANGE
PHYSICAL
SYMBOLS
FOR DIGITAL
RESOURCES
(SHARED)

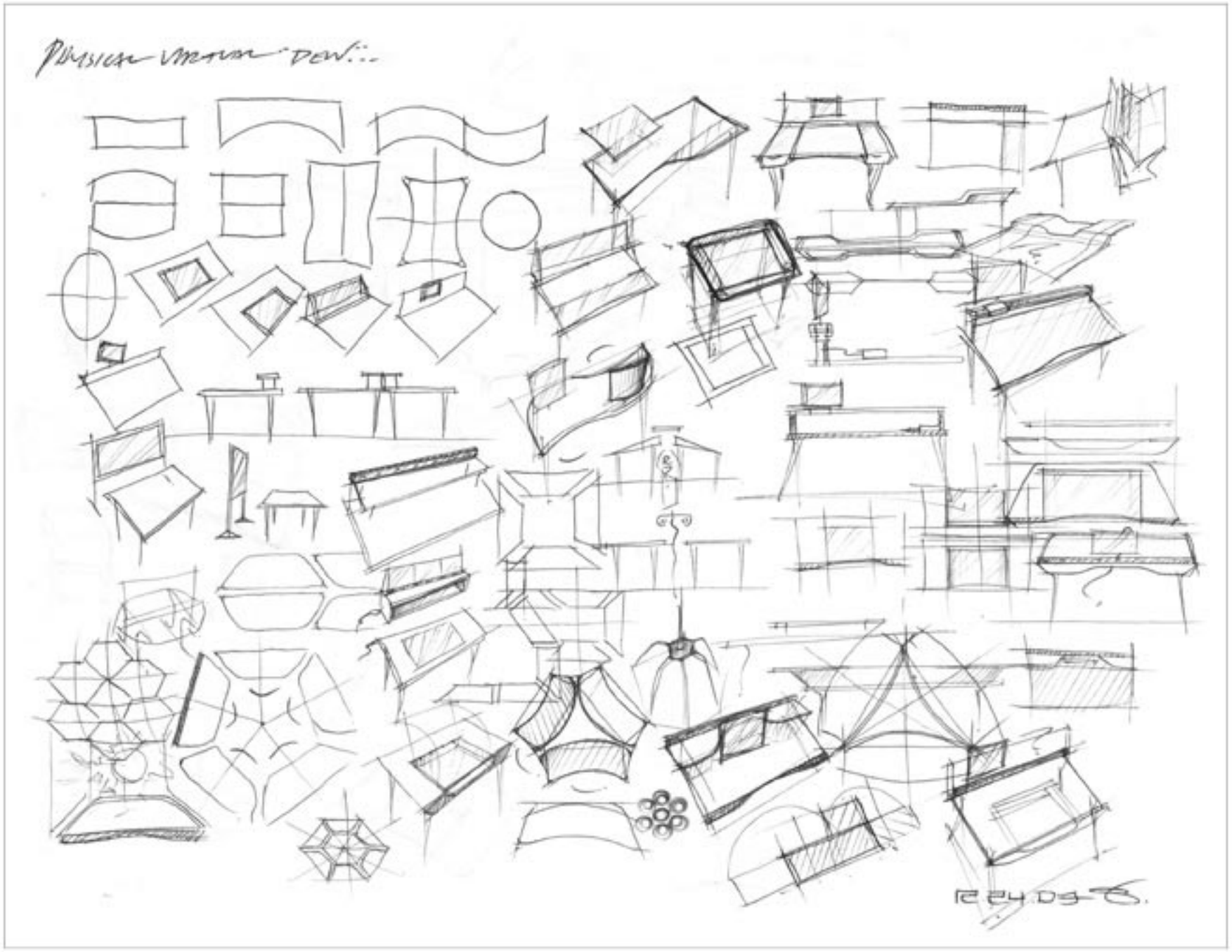
PHYSICAL · VIRTUAL

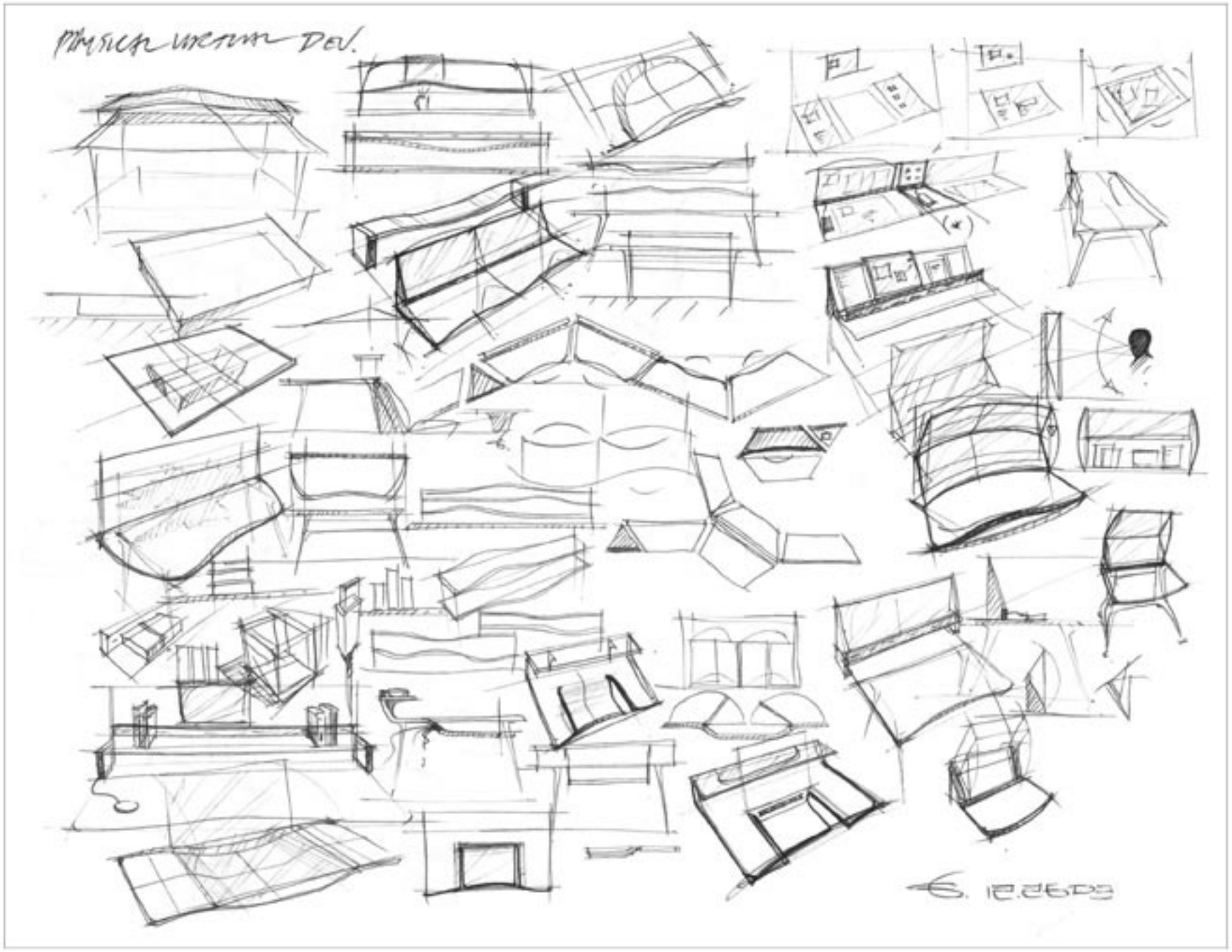

PHYSICAL · VIRTUAL
11.24.06.

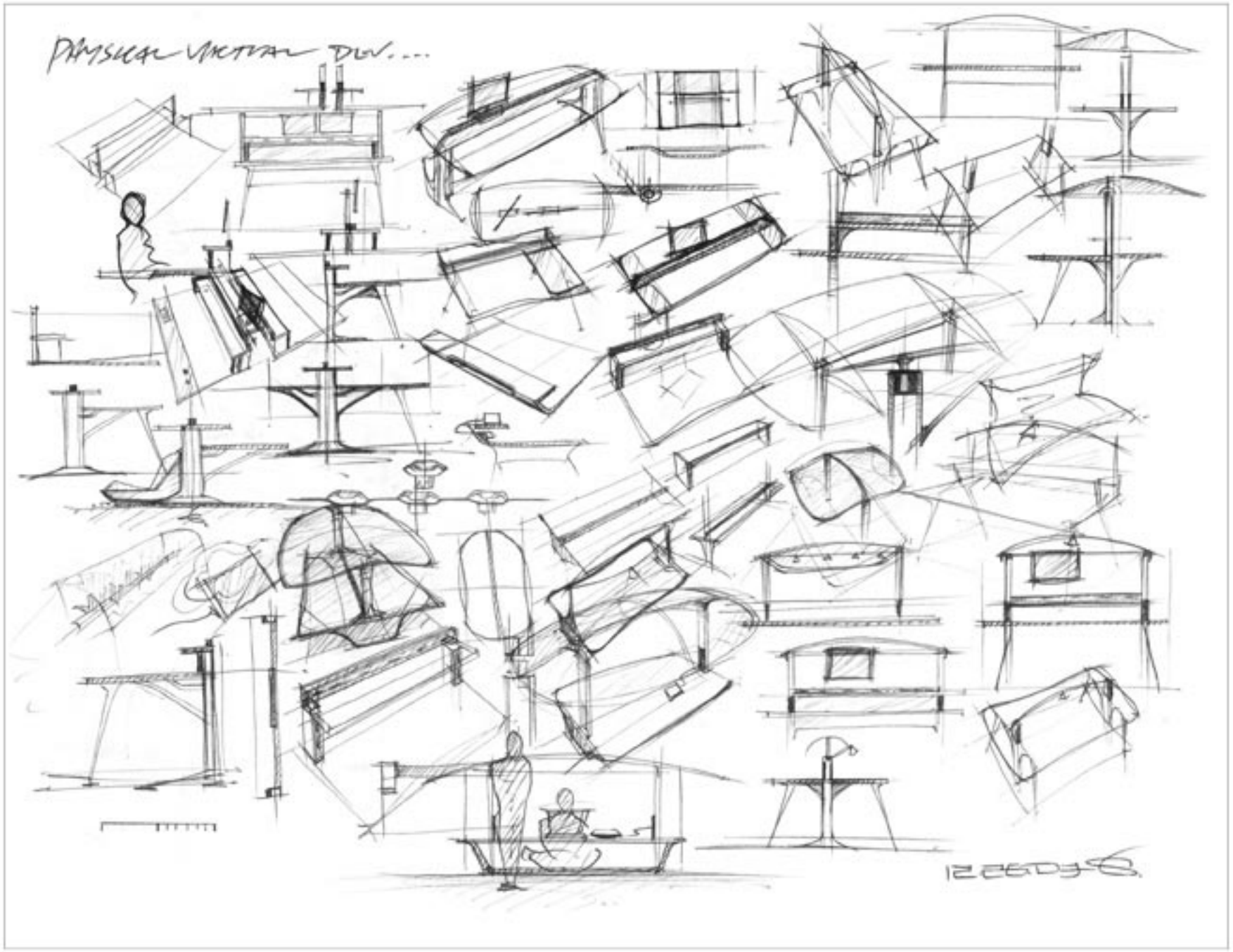


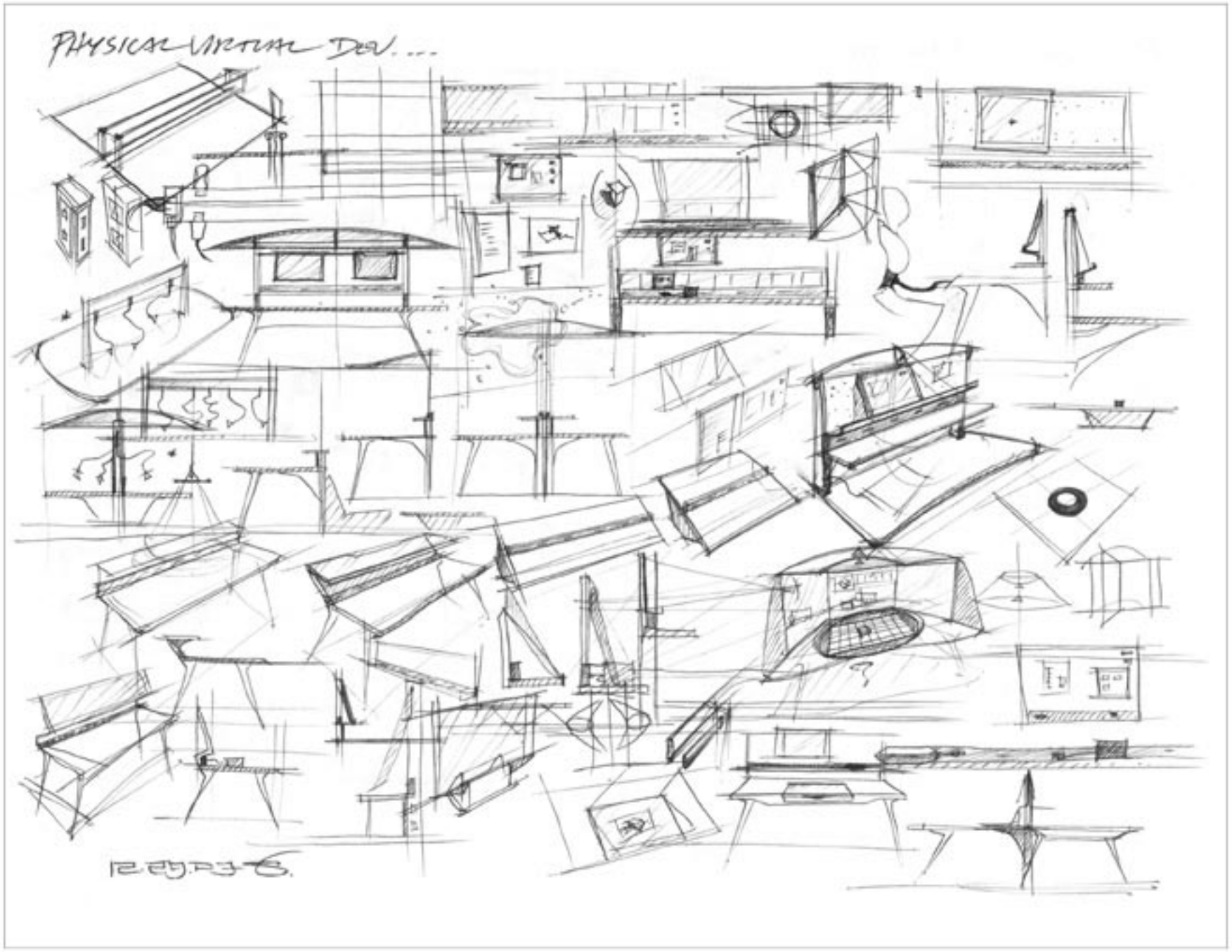


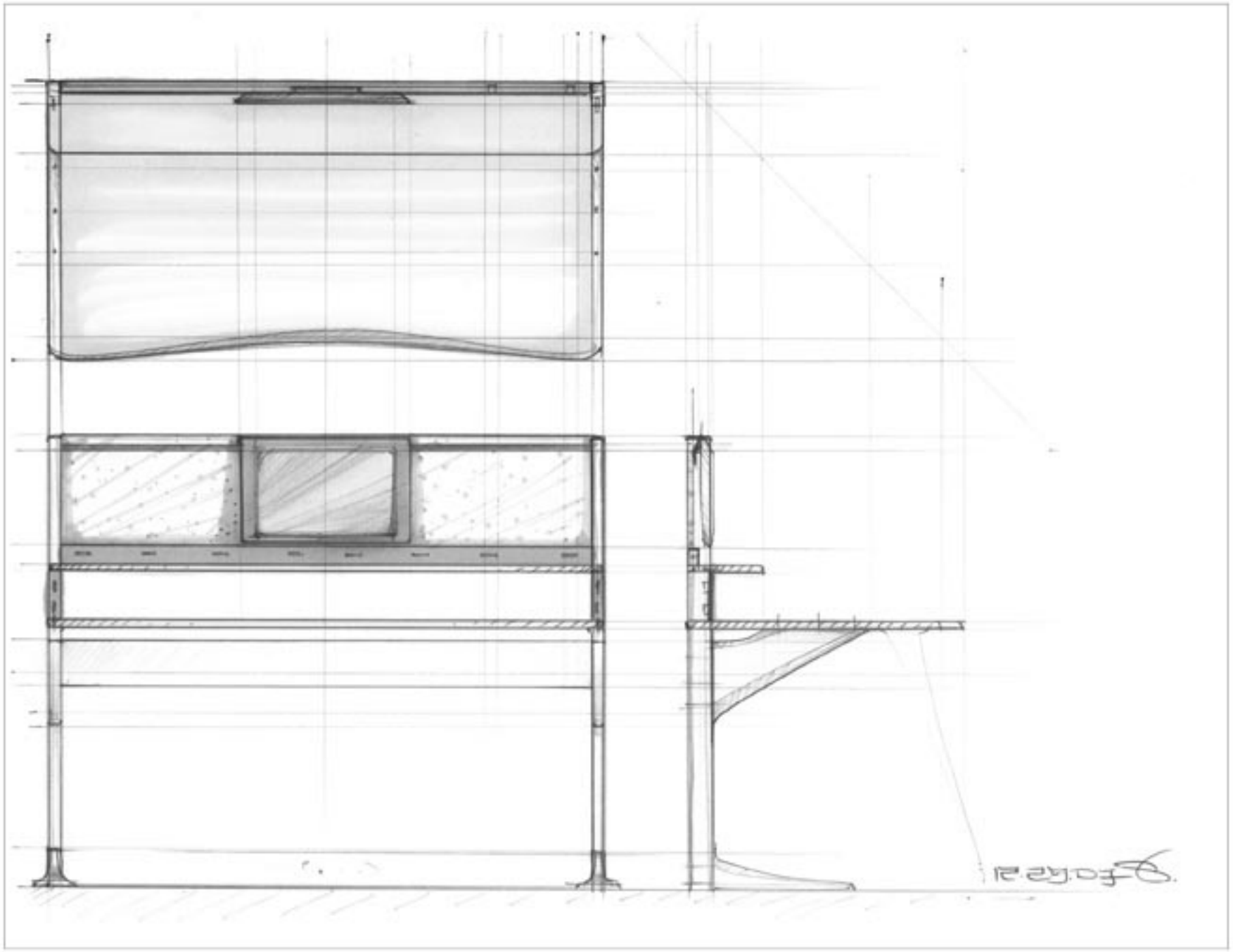


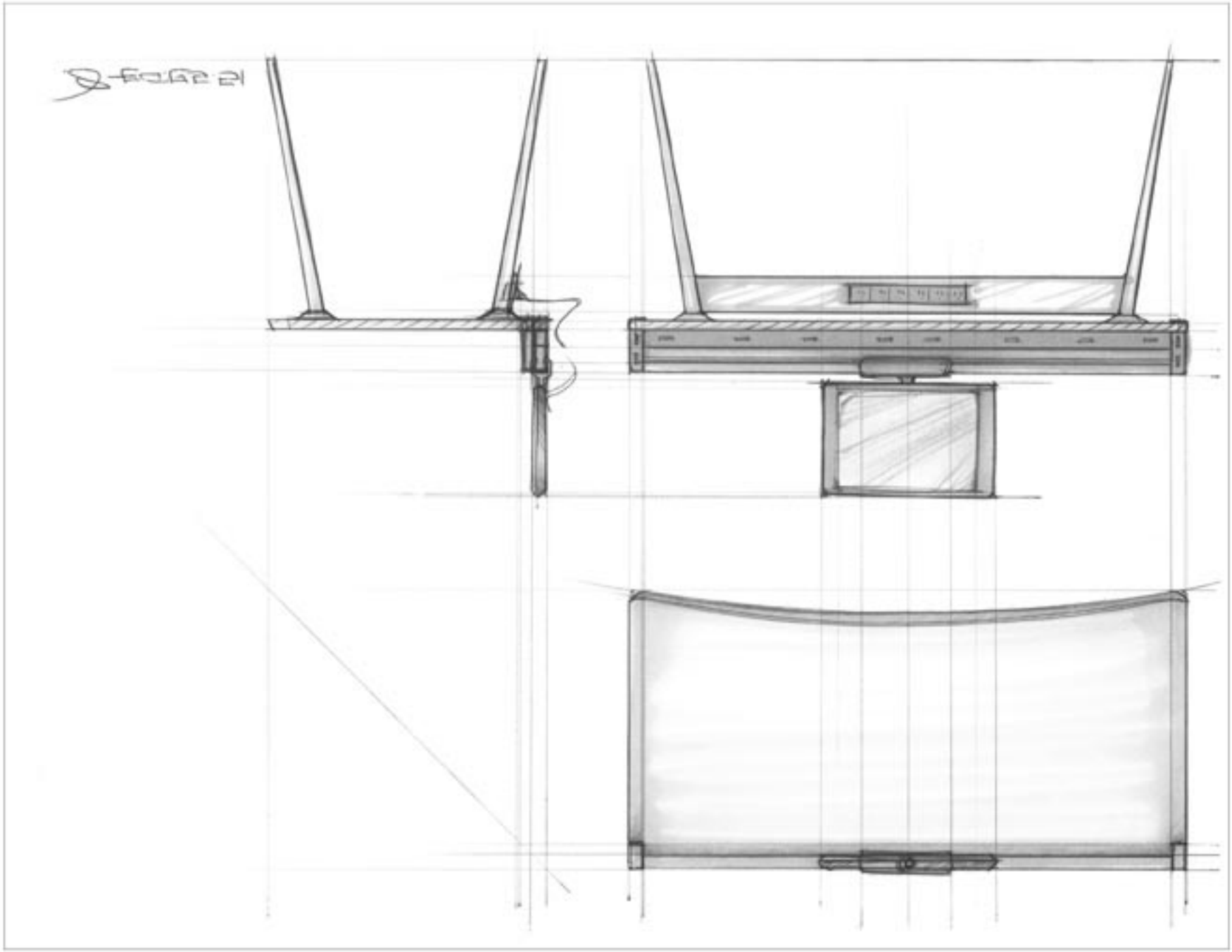


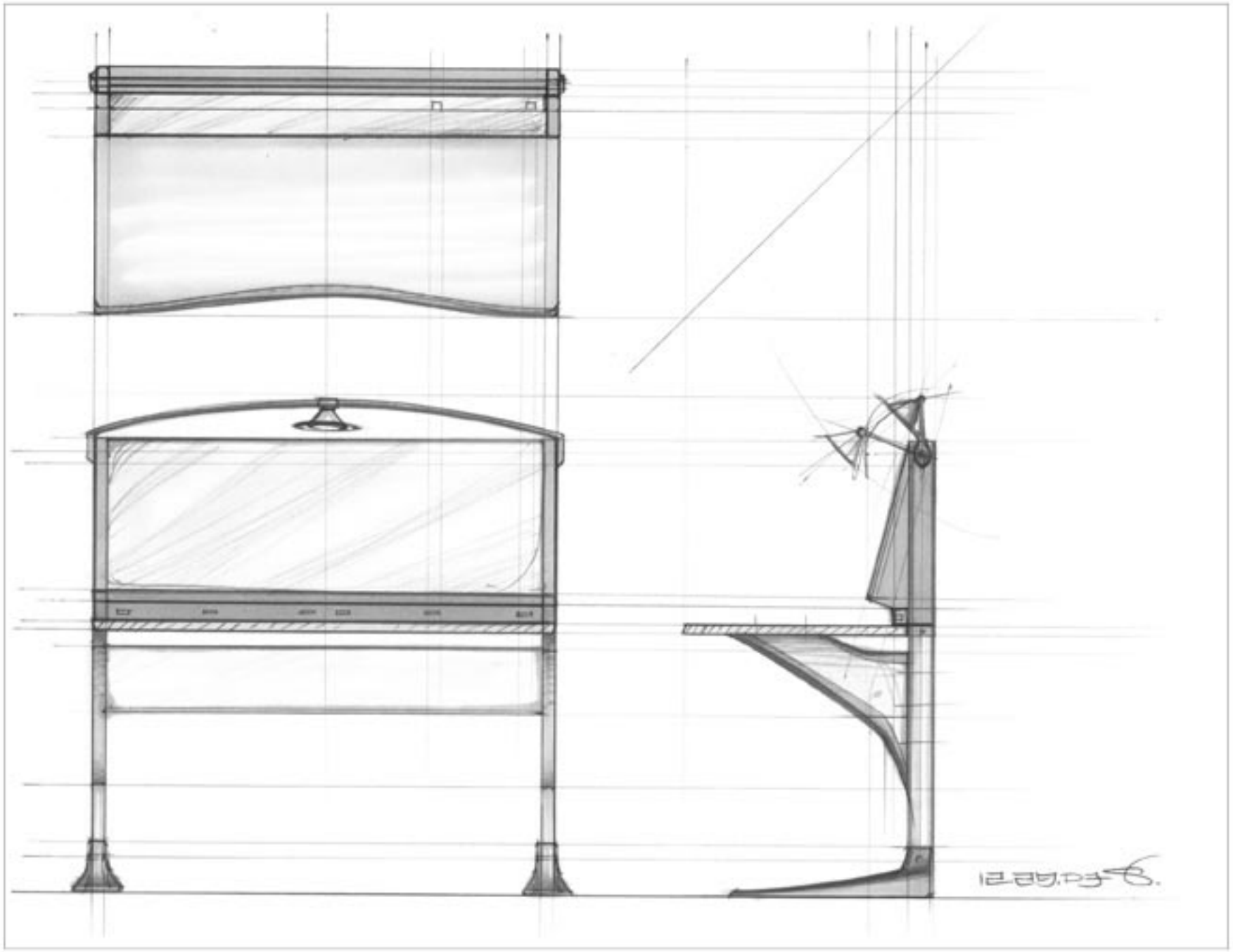


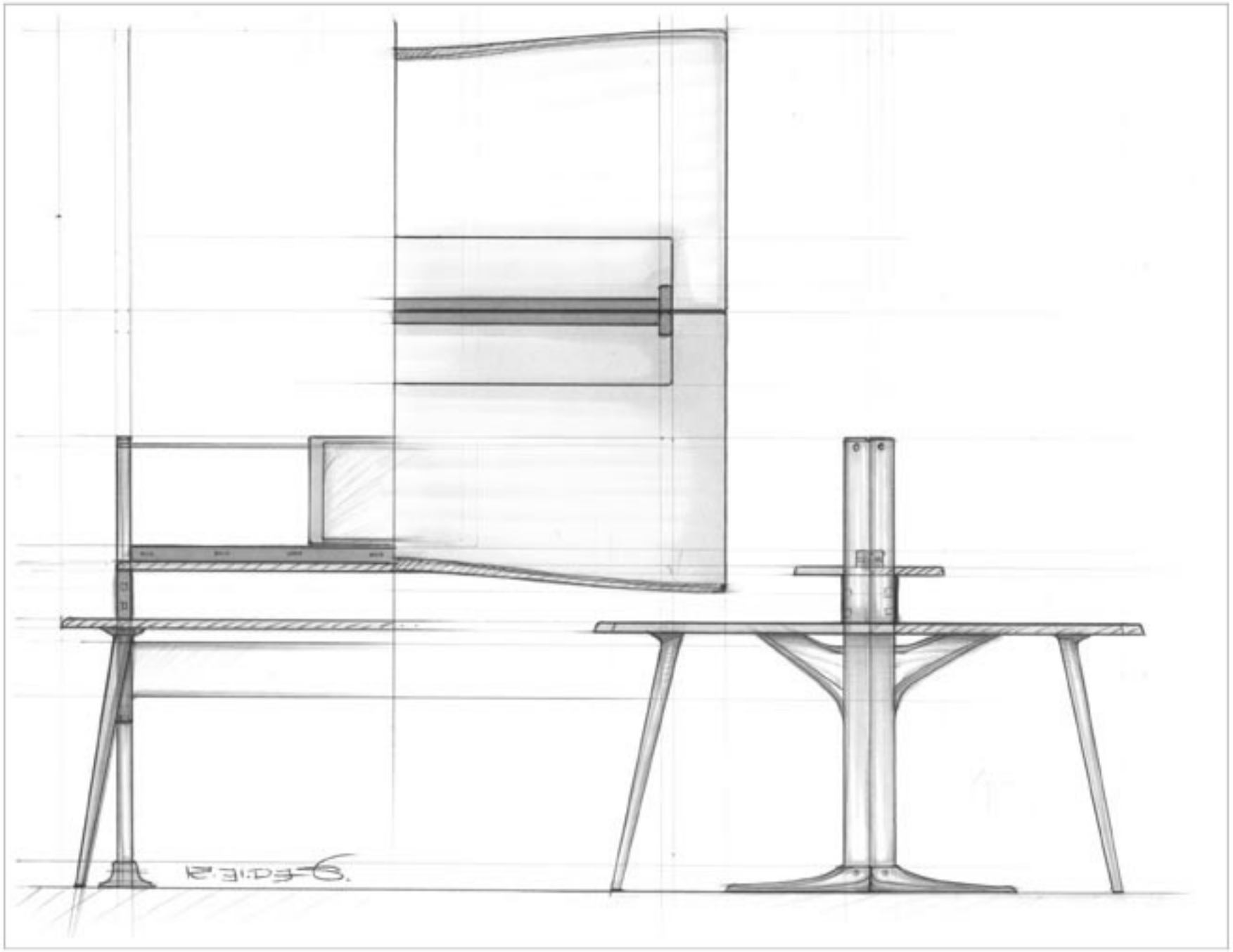

PHYSICAL VIRTUAL DOV...

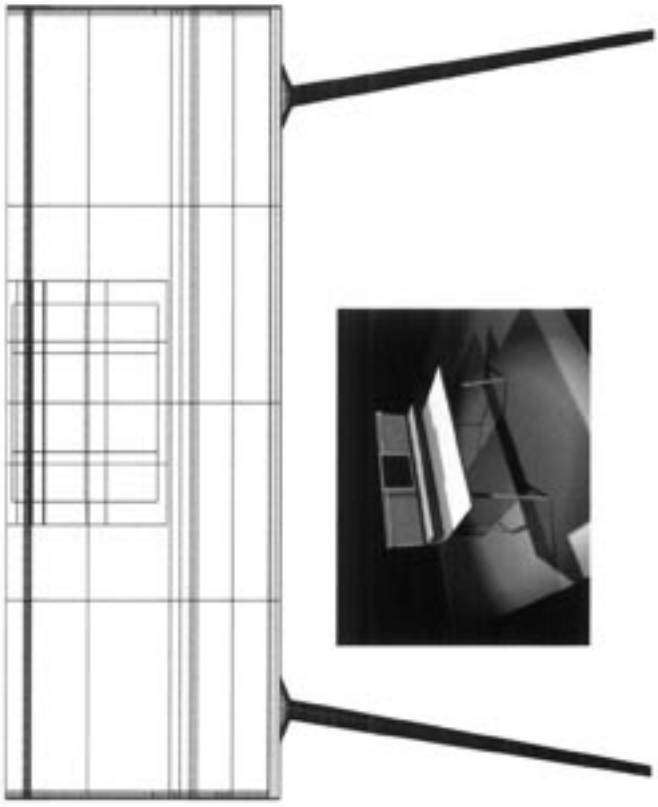

PHYSICAL VIRTUAL DEV. ...

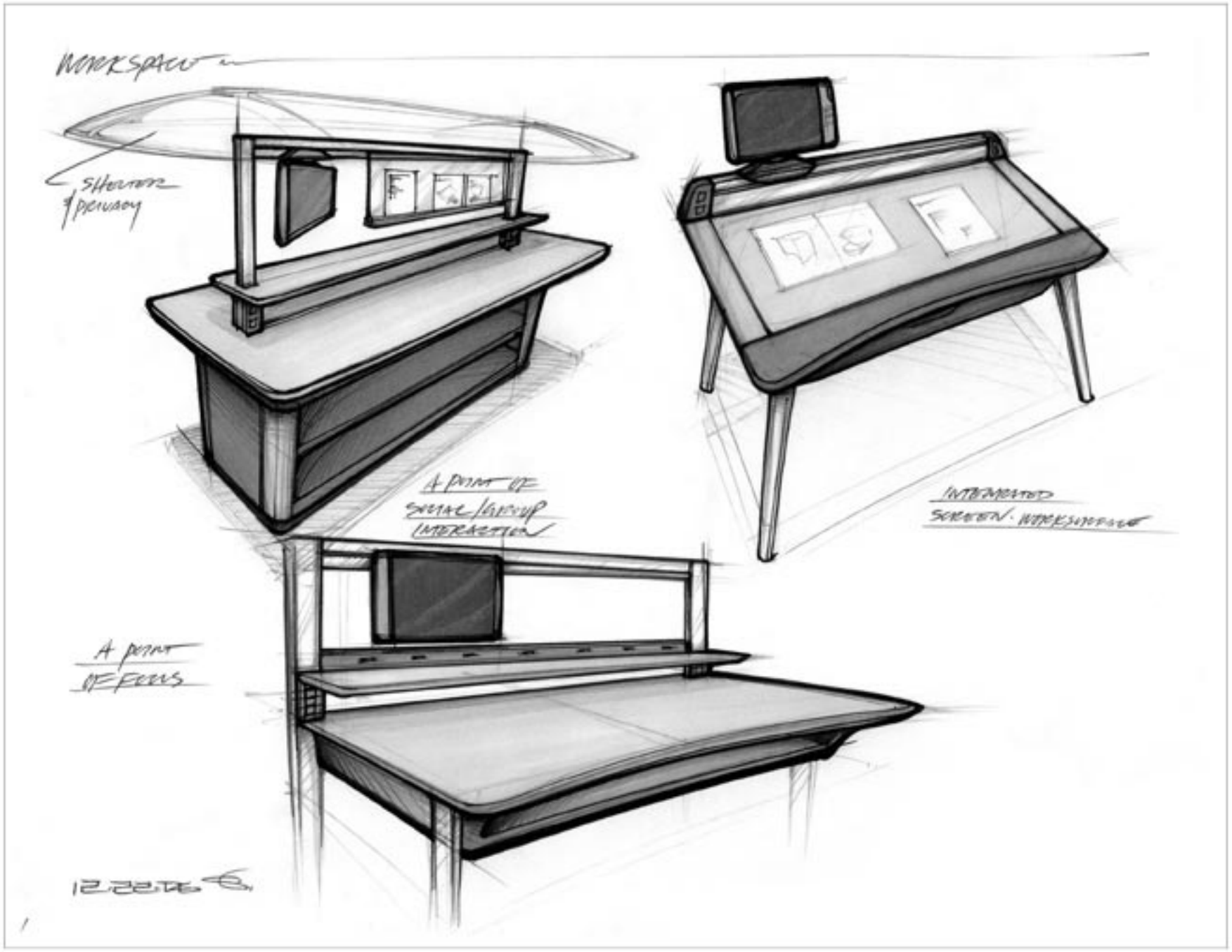


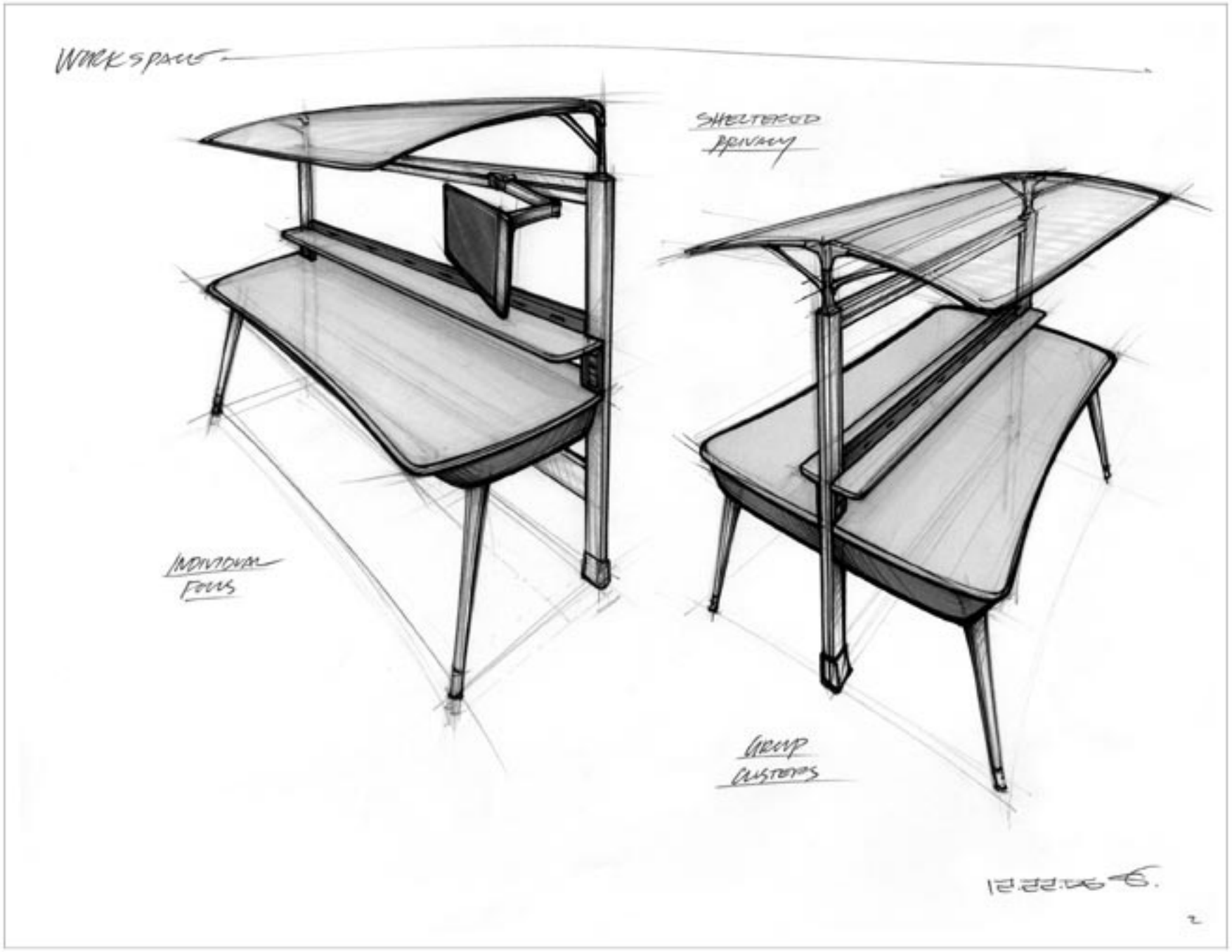


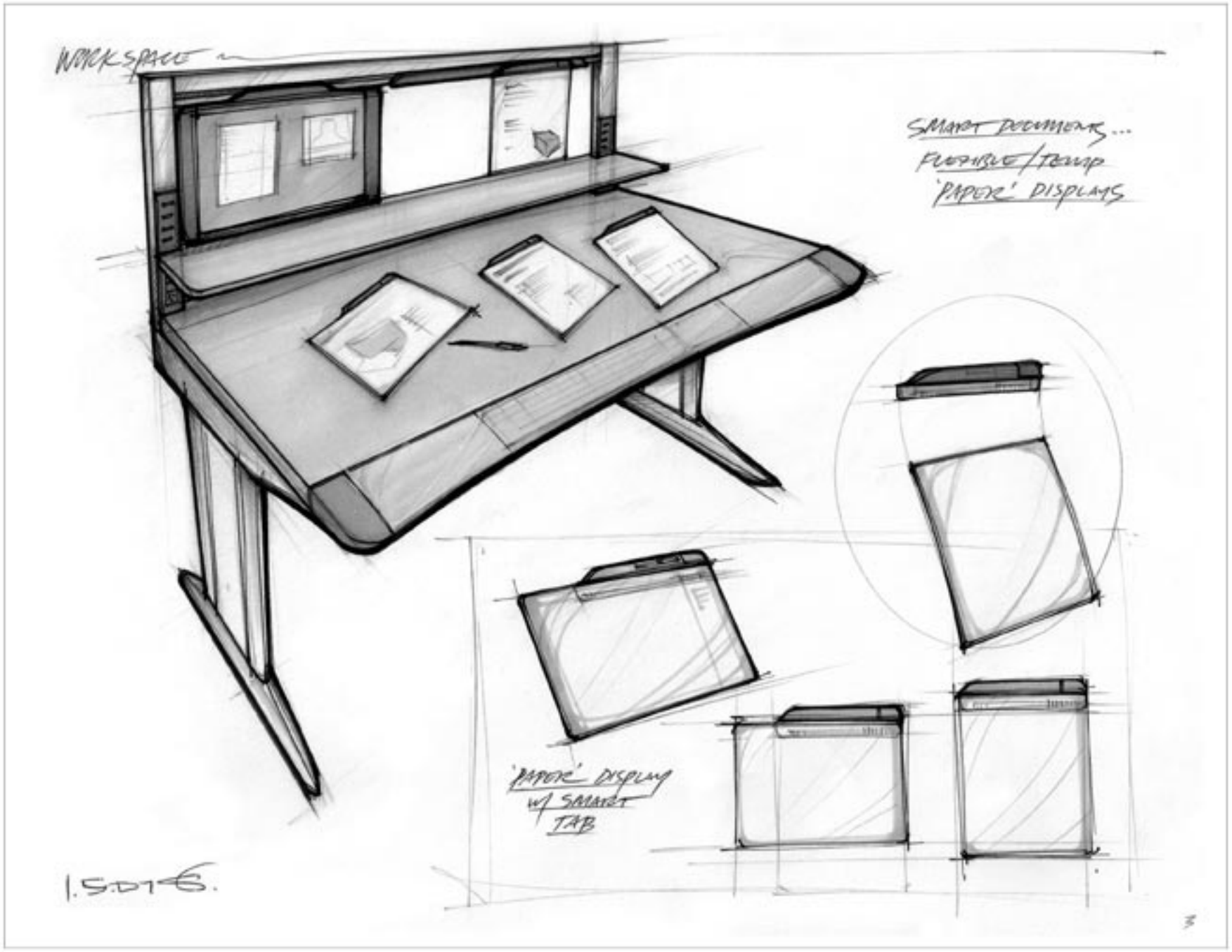


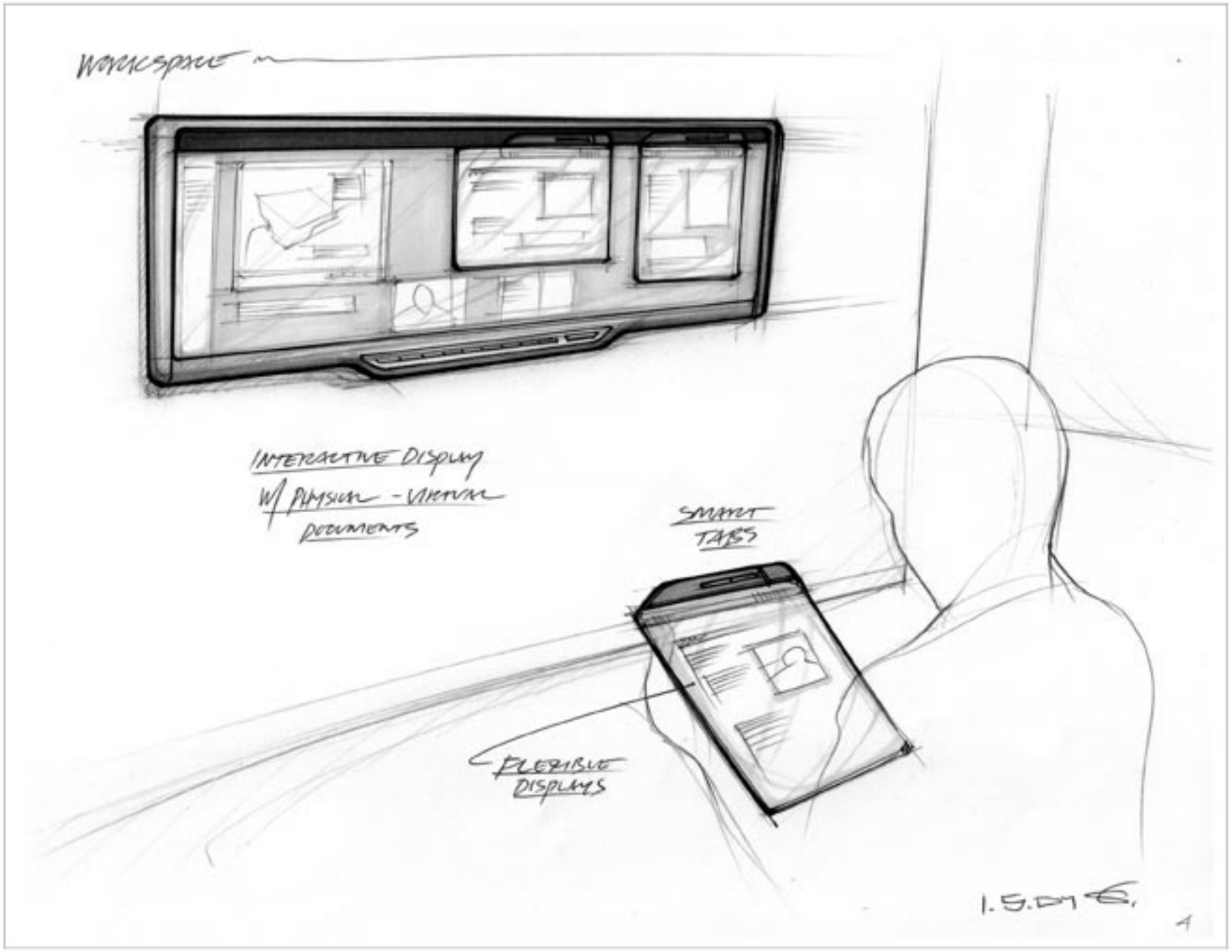


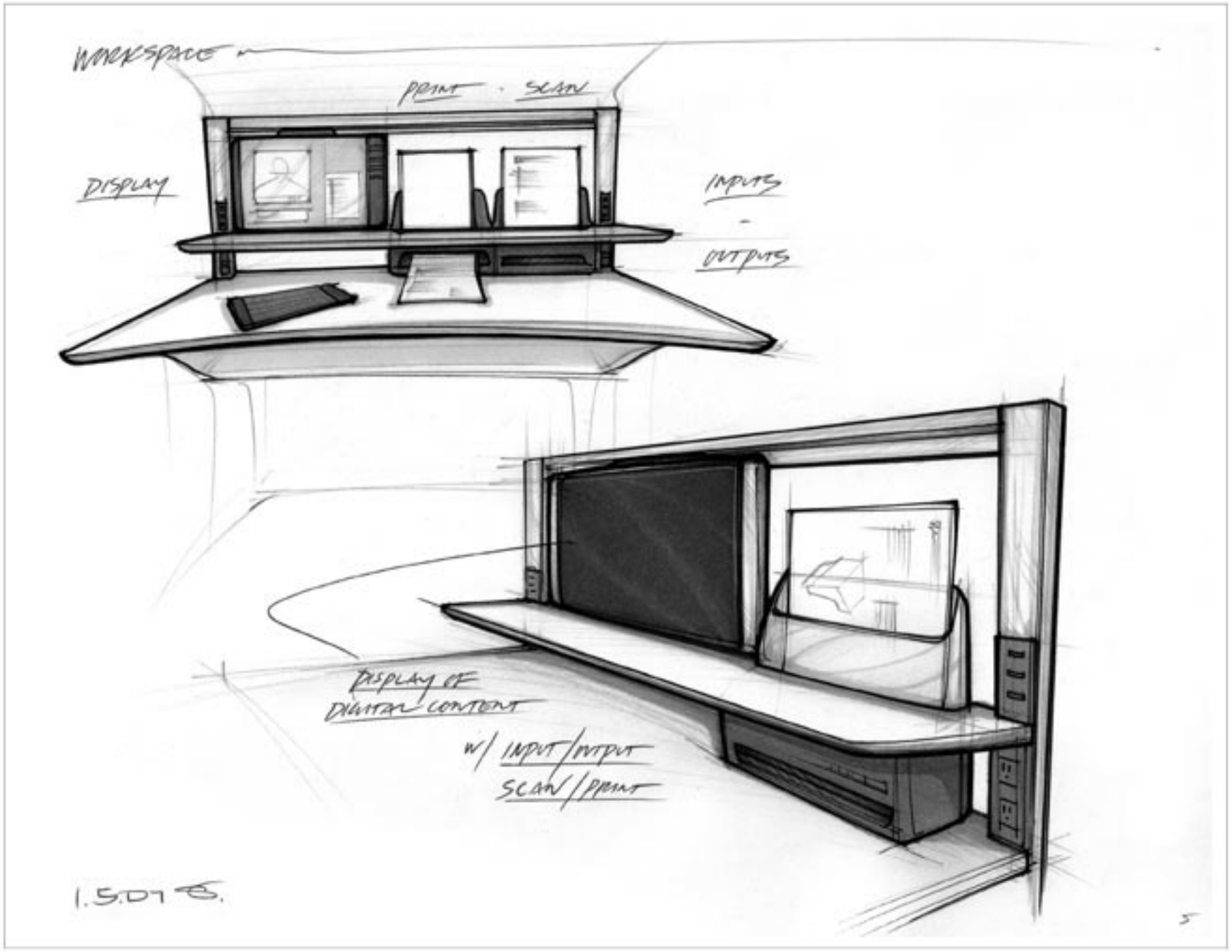


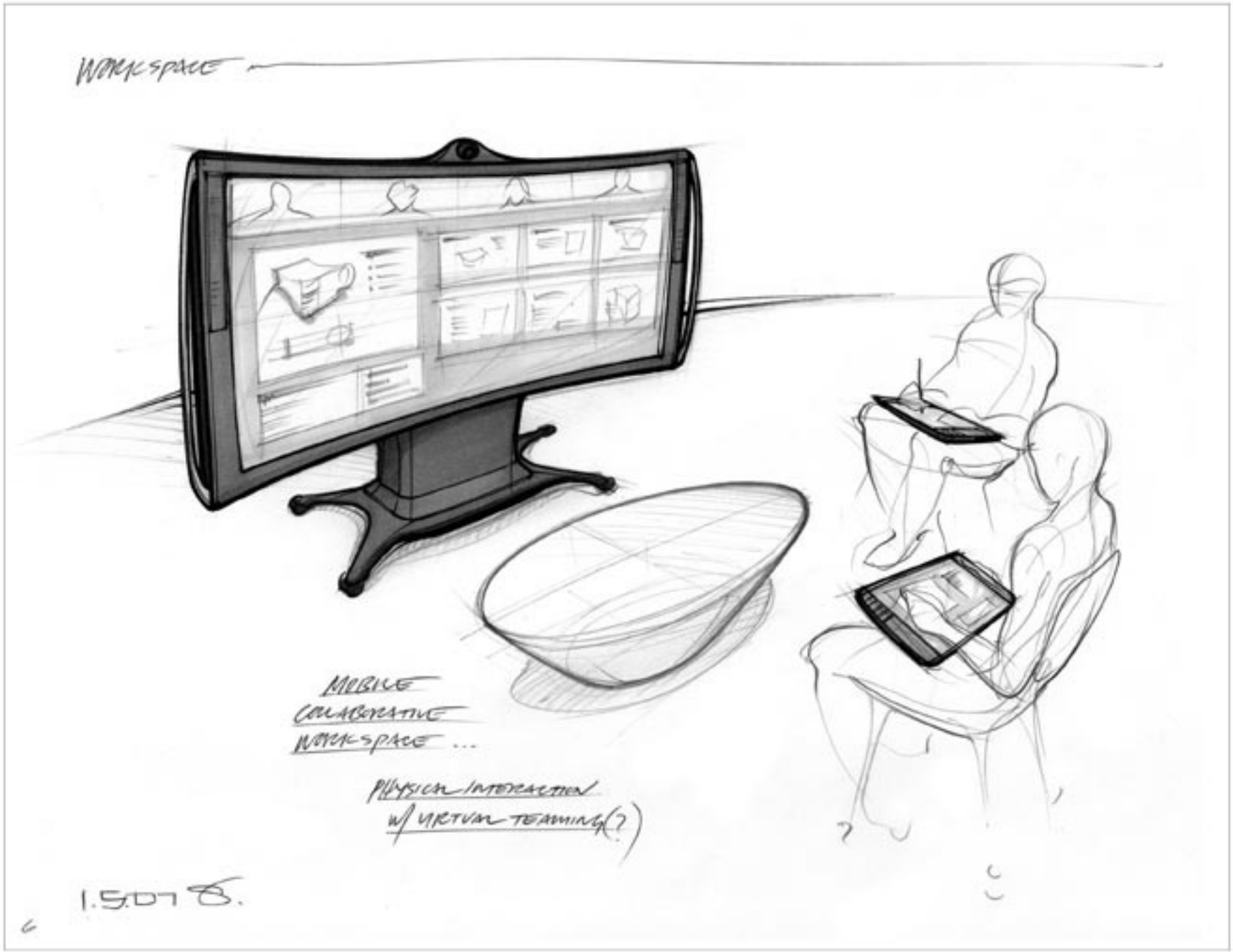

WORKSPACE
SHELVING & PRIVACY
A POINT OF SOCIAL/GROUP INTERACTION
INTEGRATED SCREEN. WORKSURFACE
A POINT OF FOCUS
12.22.06

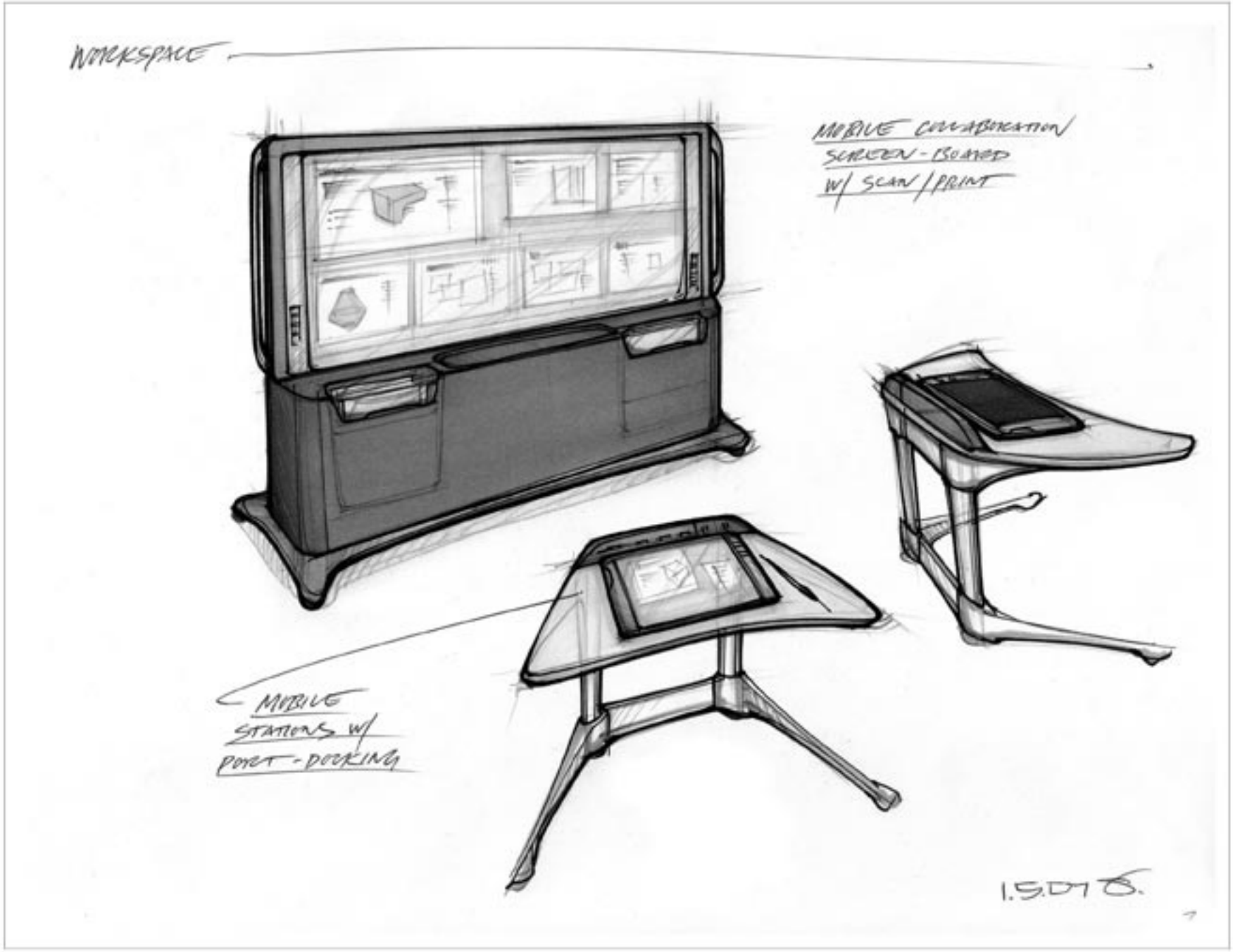

WORKSPACE
SHELTERED PRIVACY
INDIVIDUAL FOCUS
GROUP CUSTOMERS

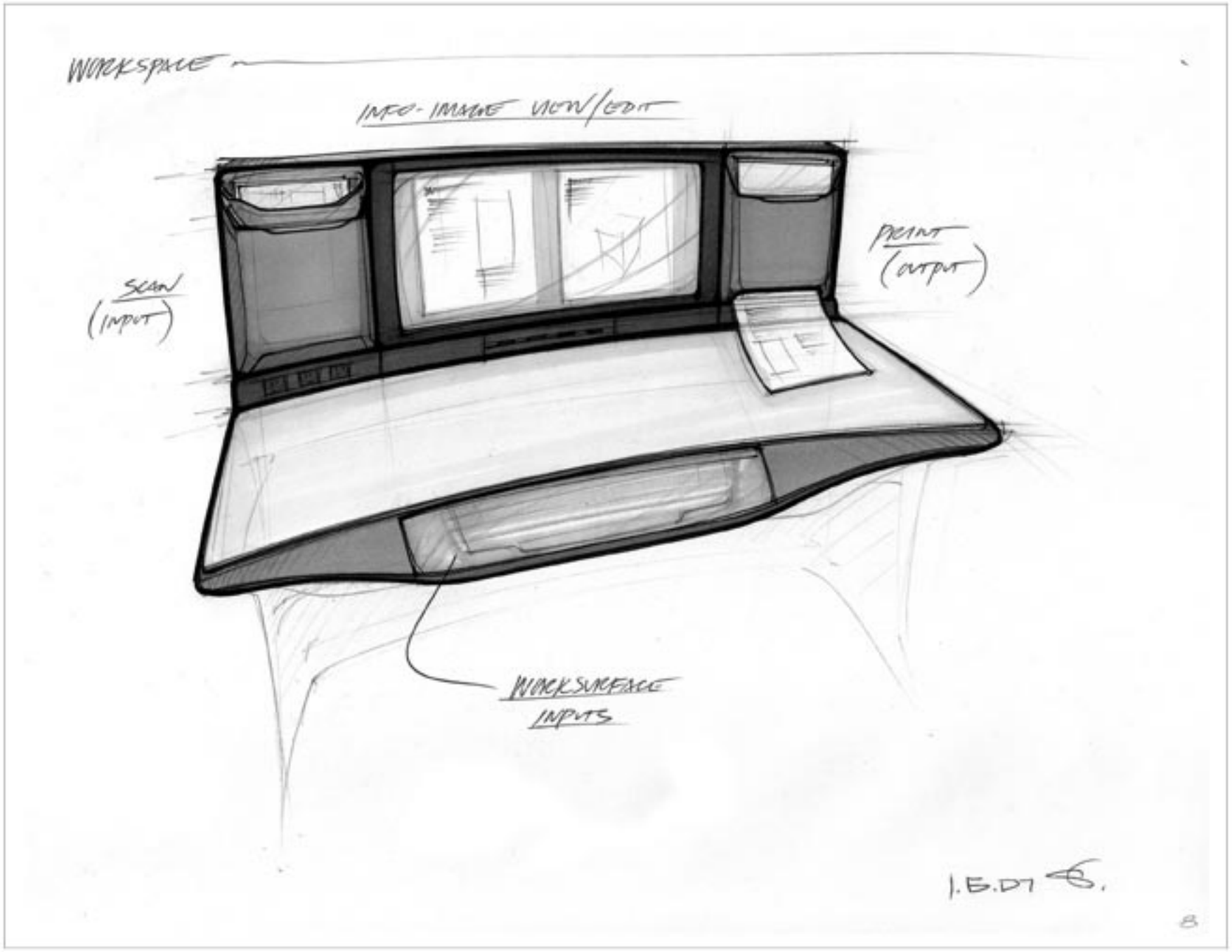

WORKSPACE
SMART DOCUMENTS...
FLEXIBLE/TEMP
'PAPER' DISPLAYS
'PAPER' DISPLAY
W/ SMART
TAB
1.5.07.

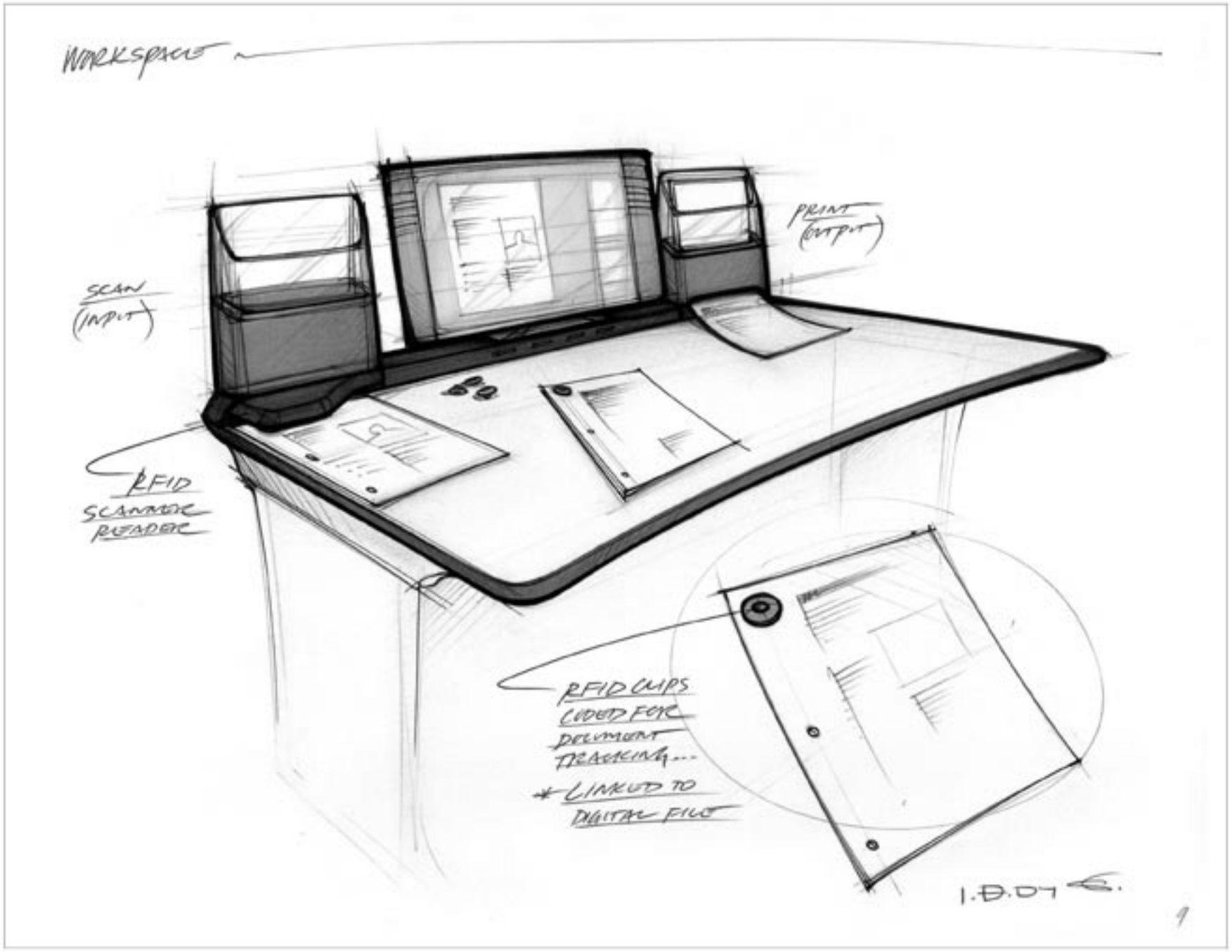

WORKSPACE
INTERACTIVE DISPLAY
W/ PHYSICAL - VIRTUAL
DOCUMENTS
SMART
TABS
FLEXIBLE
DISPLAYS
1.5.04

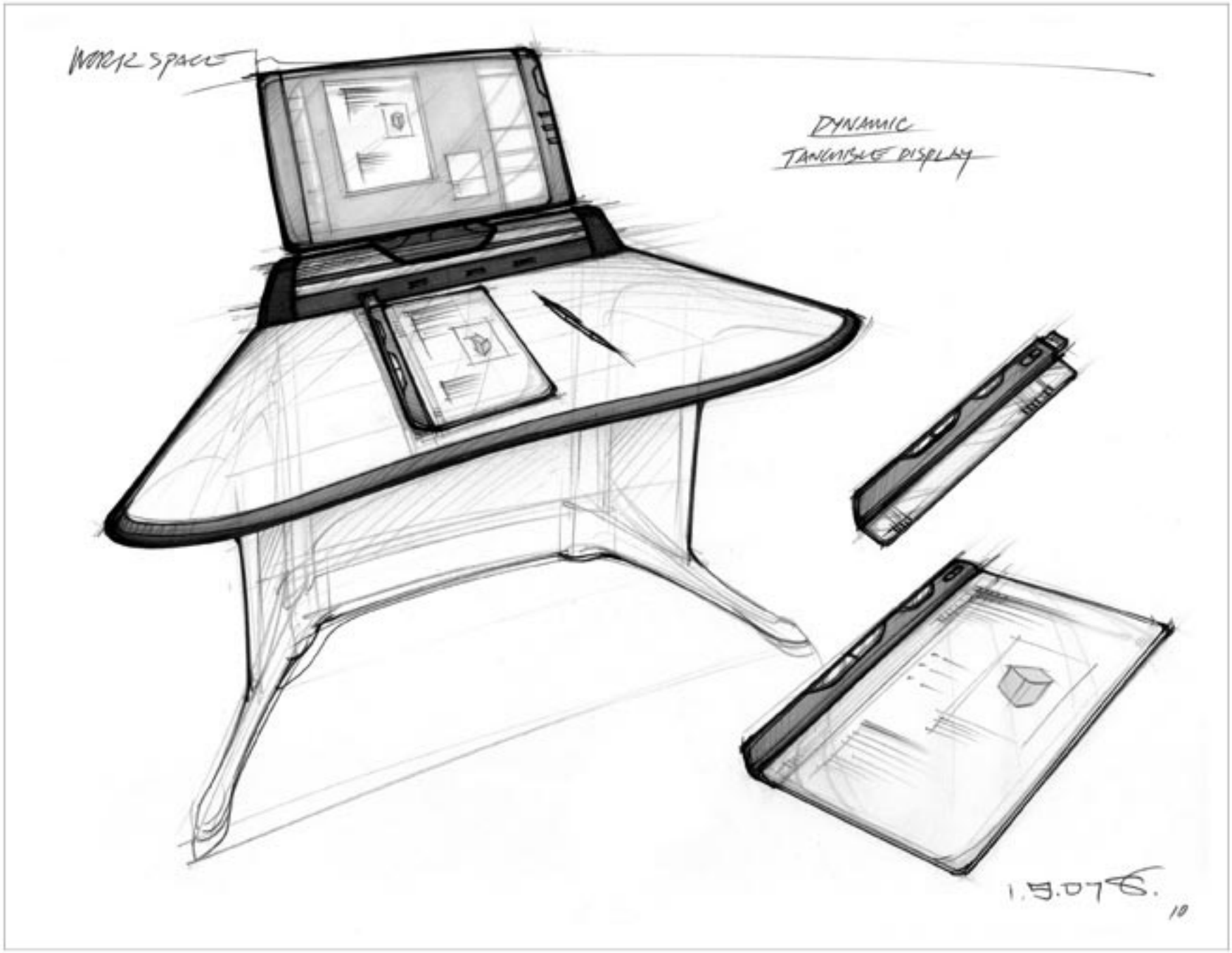

WORKSPACE
PRINT · SCAN
DISPLAY
INPUTS
OUTPUTS
DISPLAY OF
DIGITAL CONTENT
W/ INPUT/OUTPUT
SCAN/PRINT
1.5.07

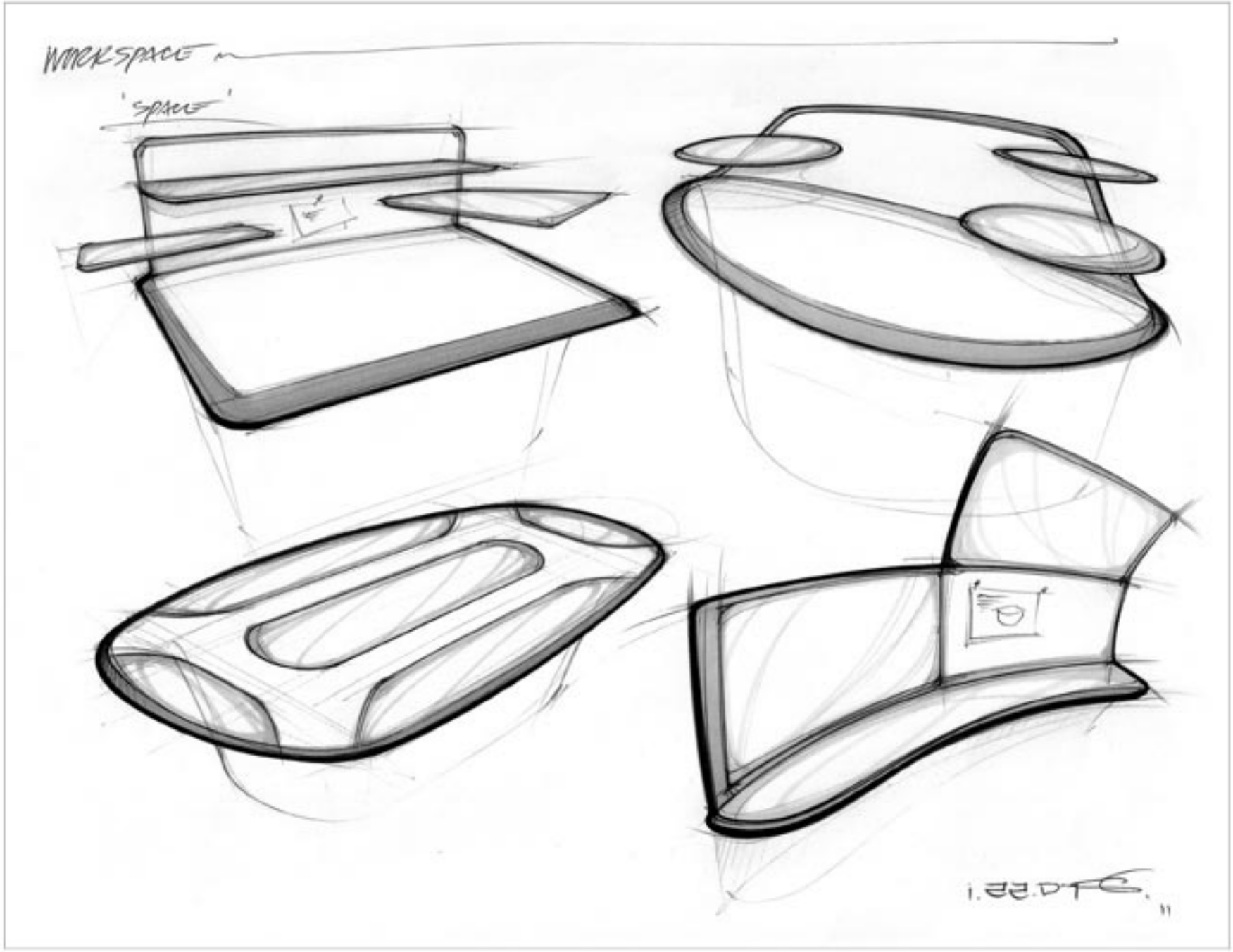

WORKSPACE
MOBILE
COLLABORATIVE
WORKSPACE ...
PHYSICAL INTERACTION
W/ VIRTUAL TEAMING (?)
1.5.07 B.

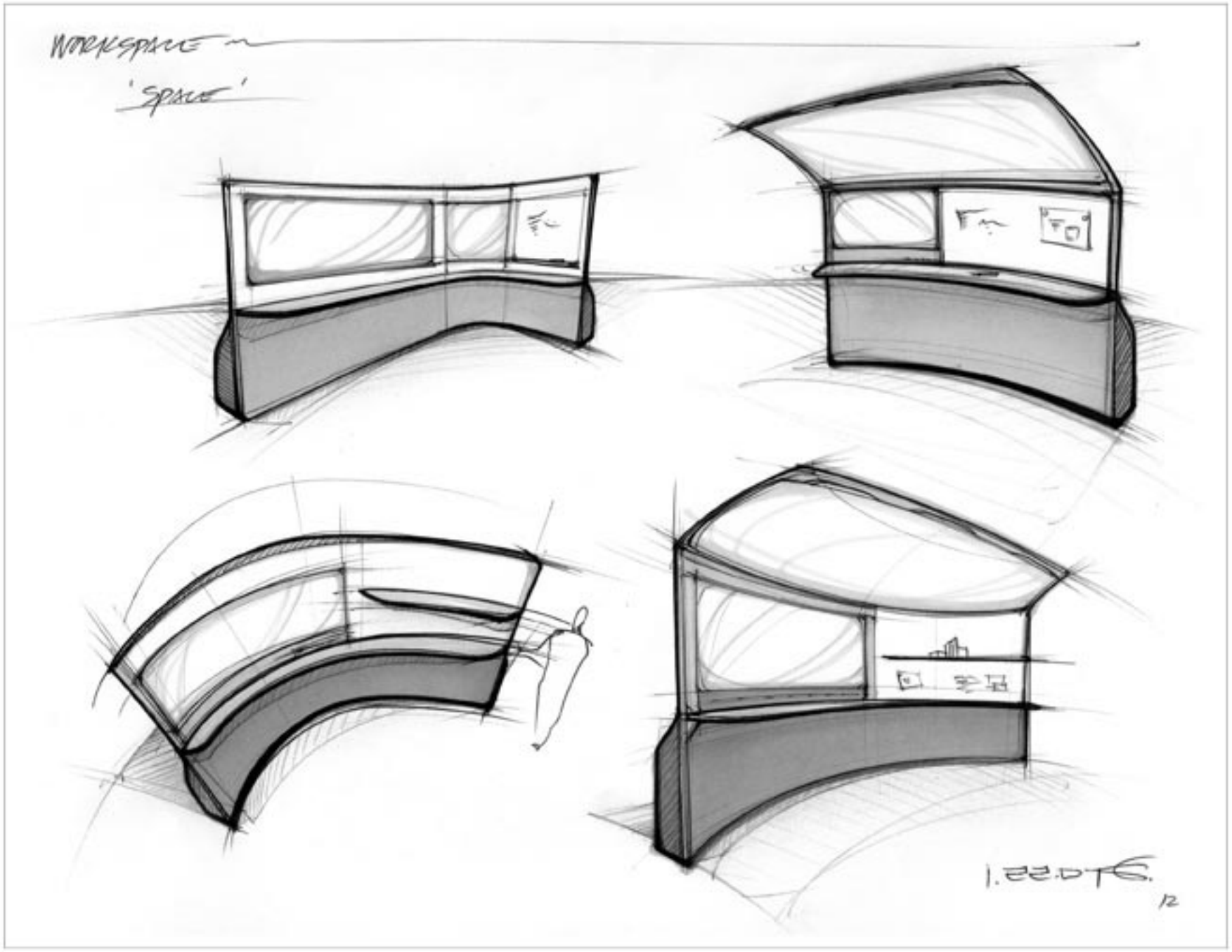

WORKSPACE
MOBILE COLLABORATION SCREEN - BOARD W/ SCAN / PRINT
MOBILE STATIONS W/ PORT - DOCKING
1.5.07 B.

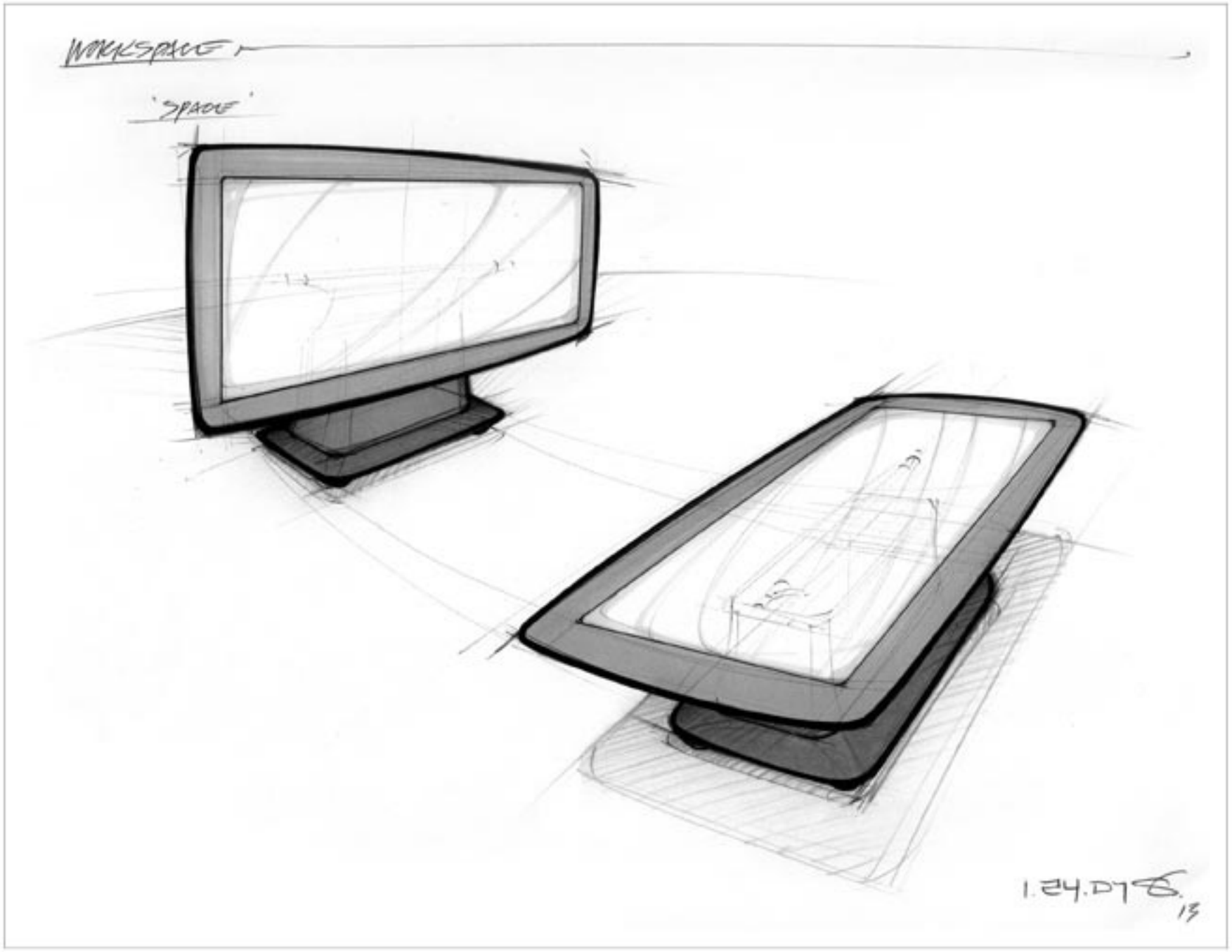

WORKSPACE
INFO-IMAGE VIEW/EDIT
SCAN
(INPUT)
PRINT
(OUTPUT)
WORKSURFACE
INPUTS
1.5.07
8

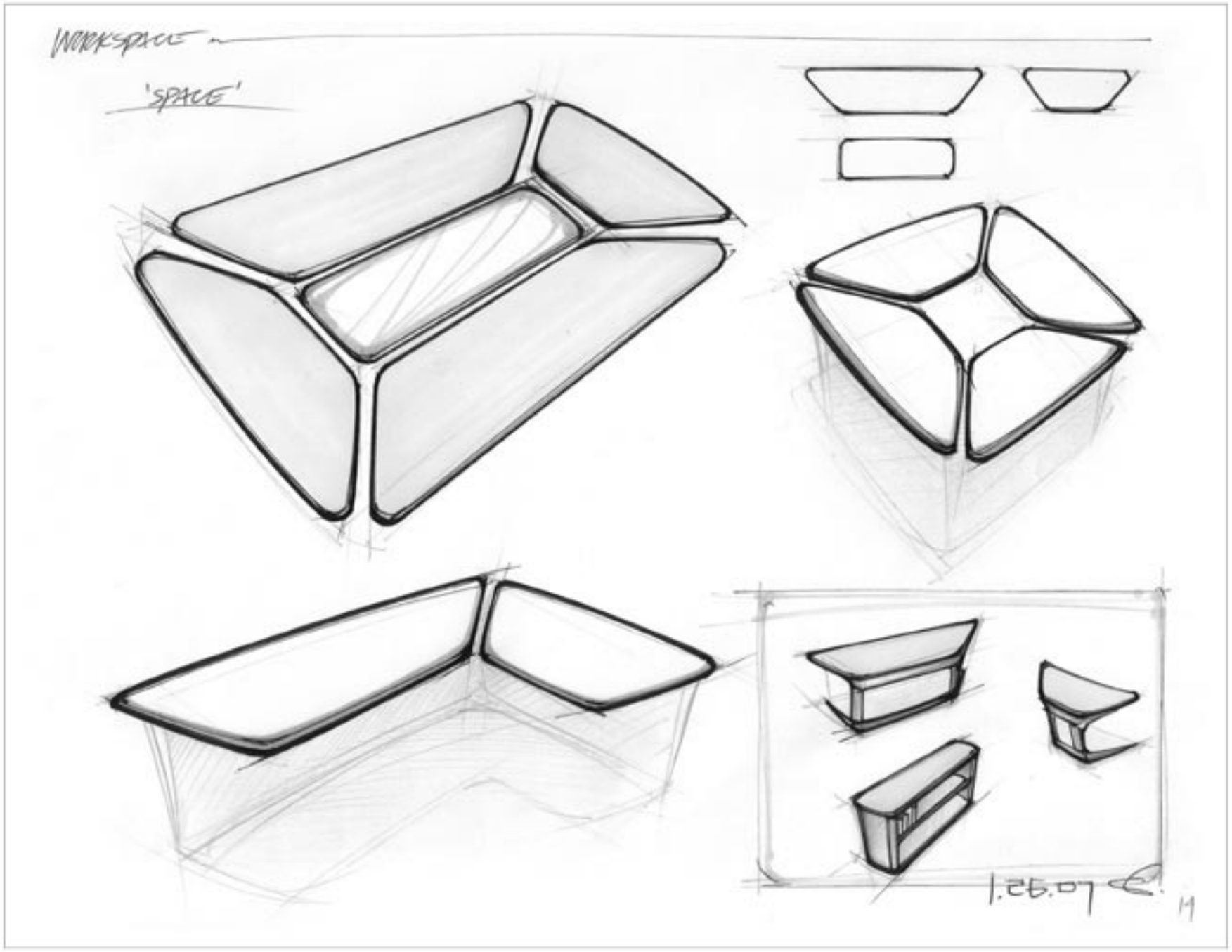

WORKSPACE
SCAN (INPUT)
PRINT (OUTPUT)
RFID SCANNER READER
RFID CHIPS CODED FOR DOCUMENT TRACKING...
* LINKED TO DIGITAL FILE
I.D.07

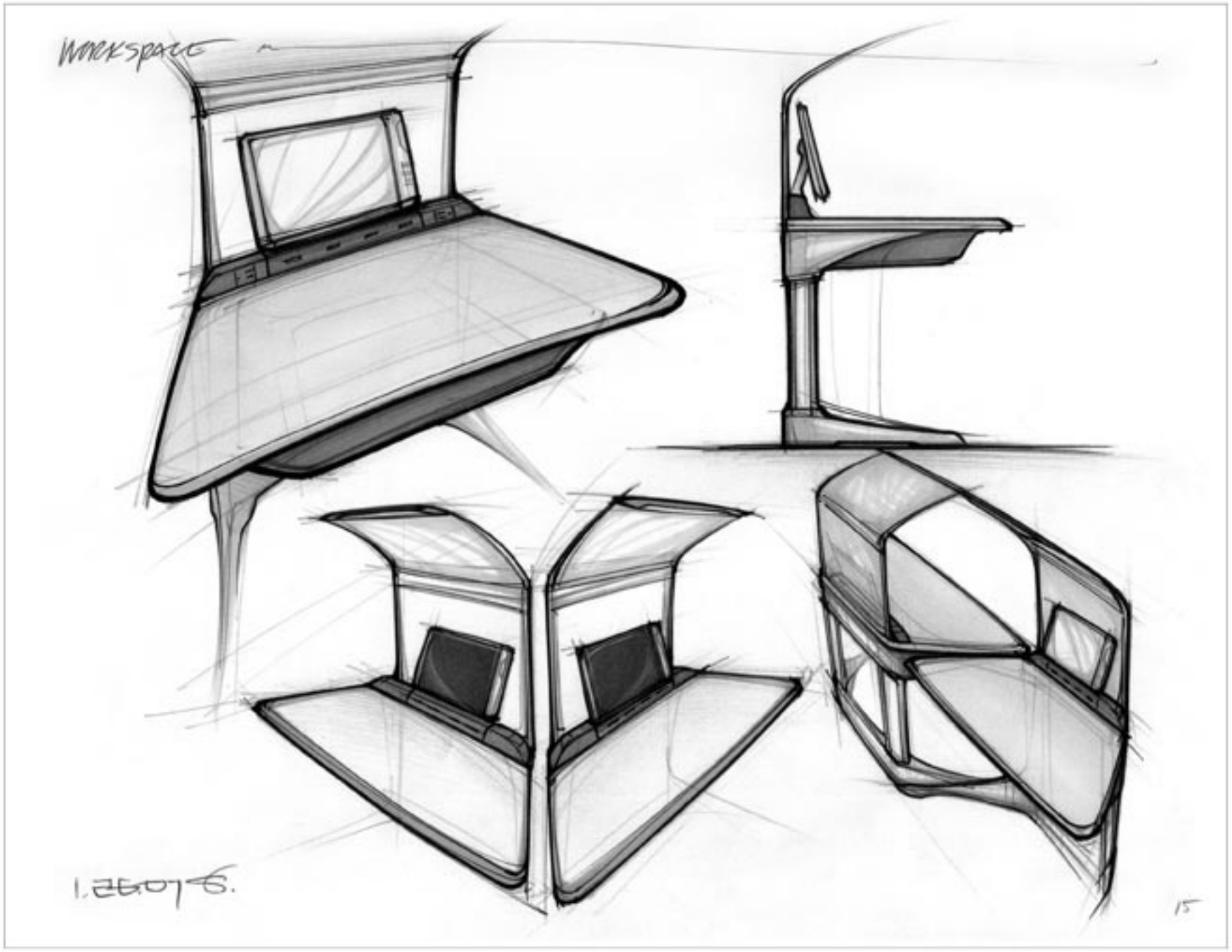

WORK SPACE
DYNAMIC
TANGIBLE DISPLAY
1.9.07 G.
10

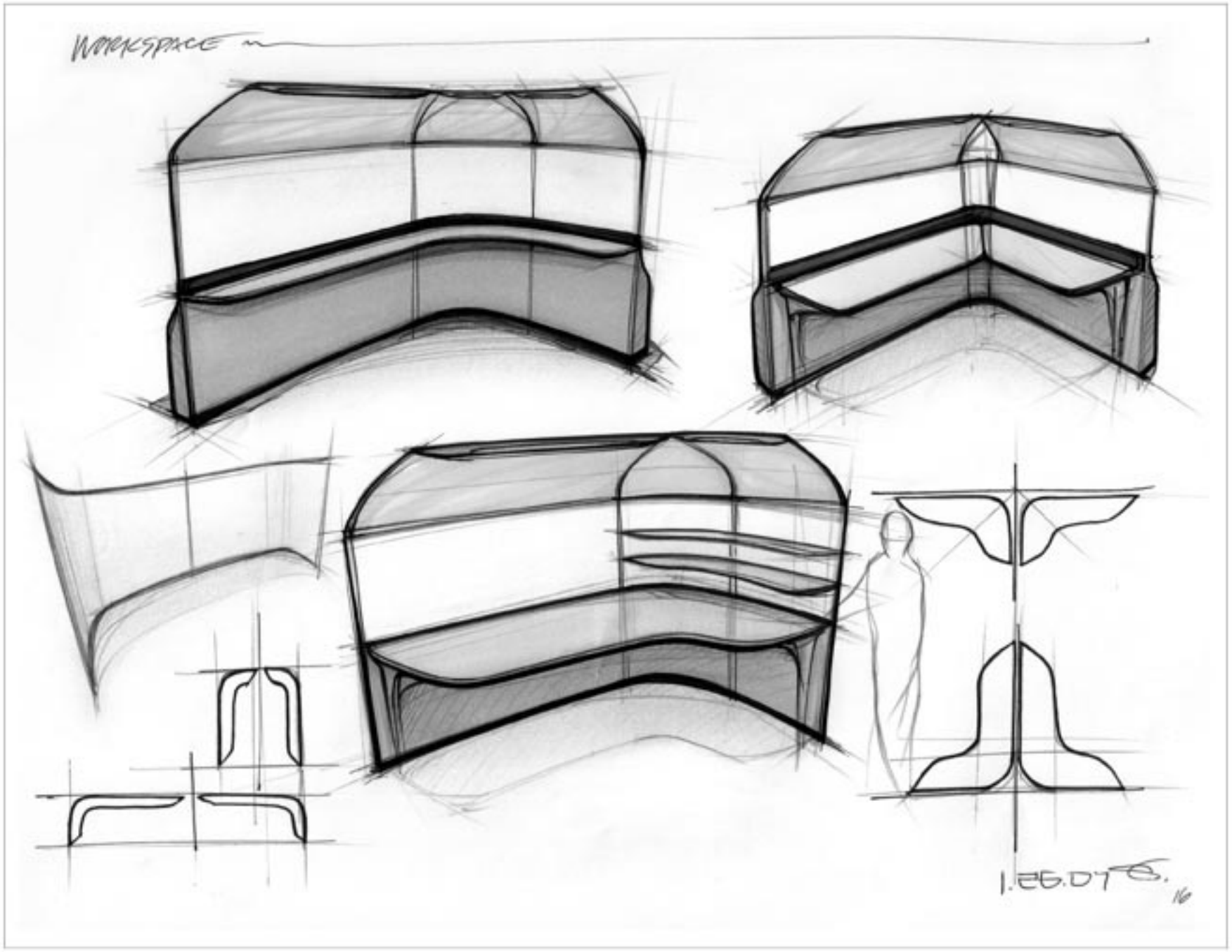

WORKSPACE
'SPACE'

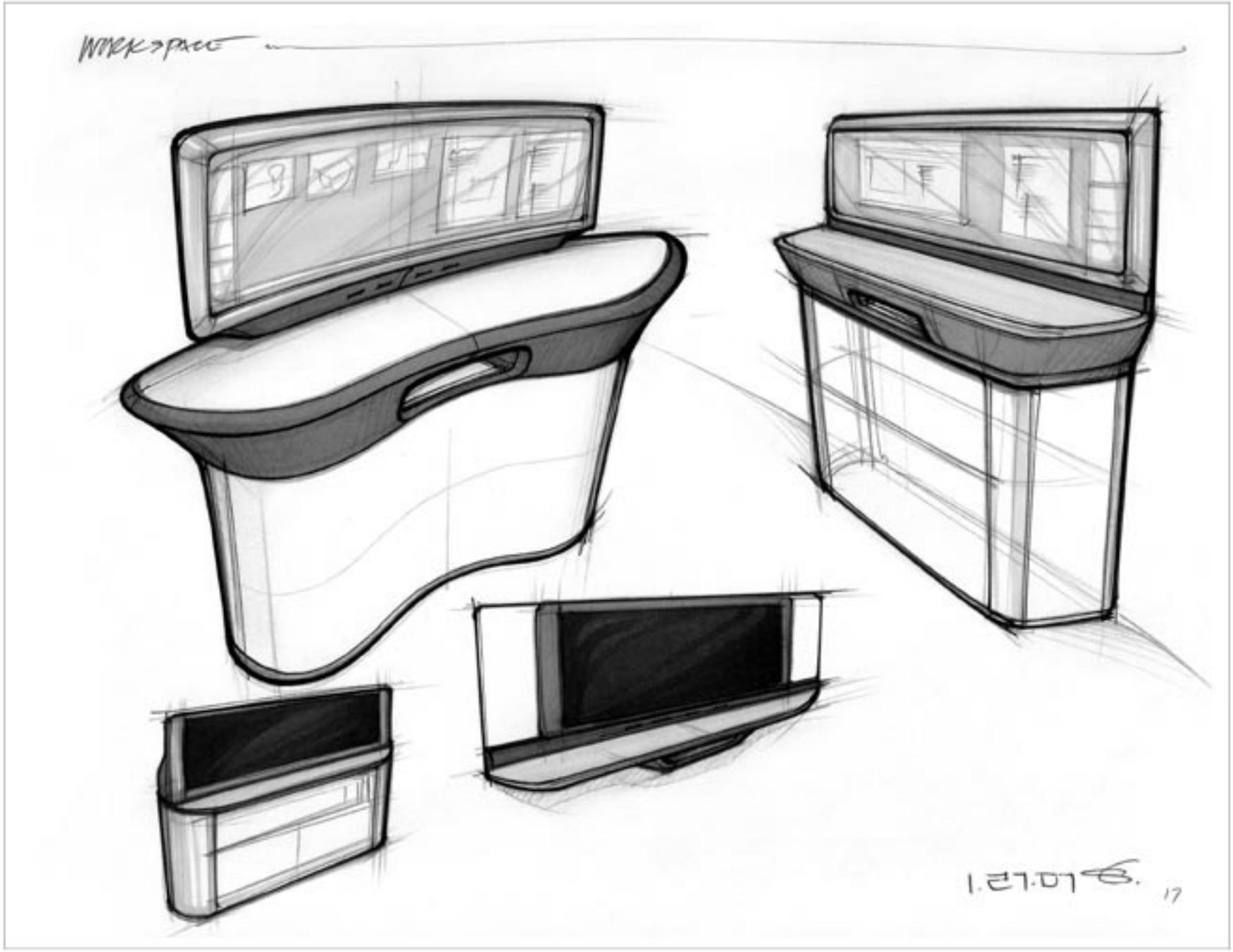

WORKSPACE
'SPACE'

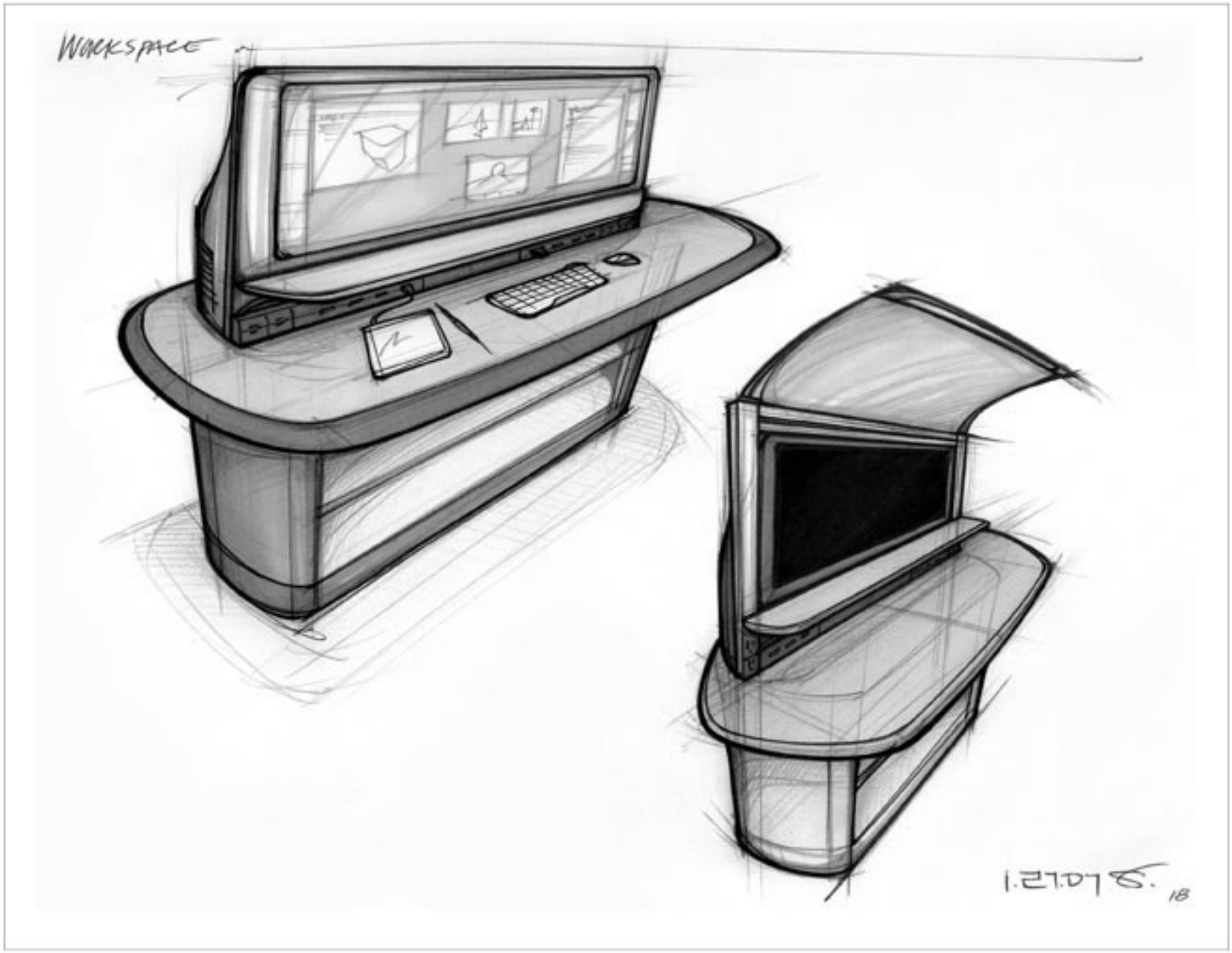

WORKSPACE
'SPACE'
1.24.07

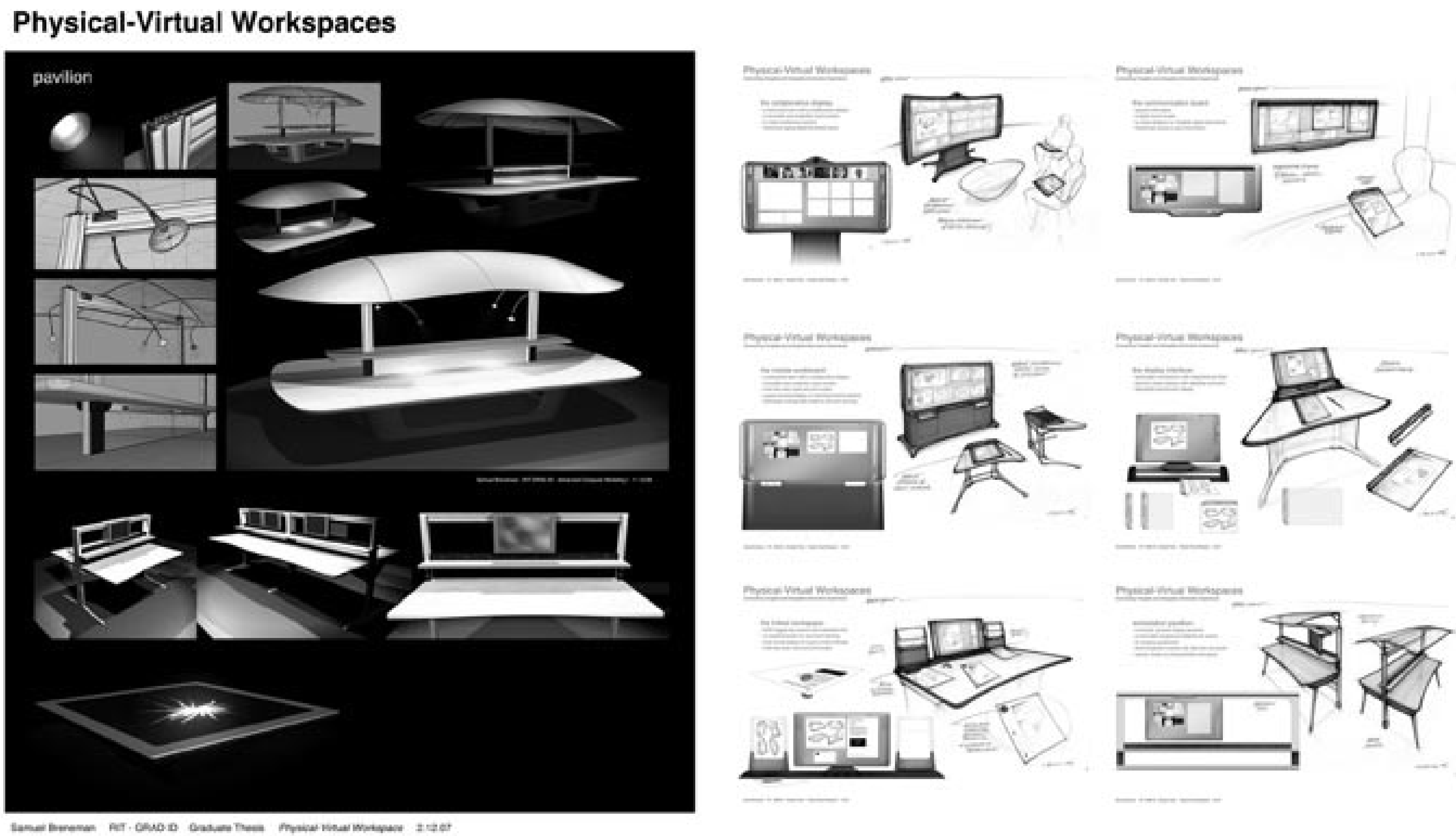

WORKSPACE
'SPACE'
1.26.07

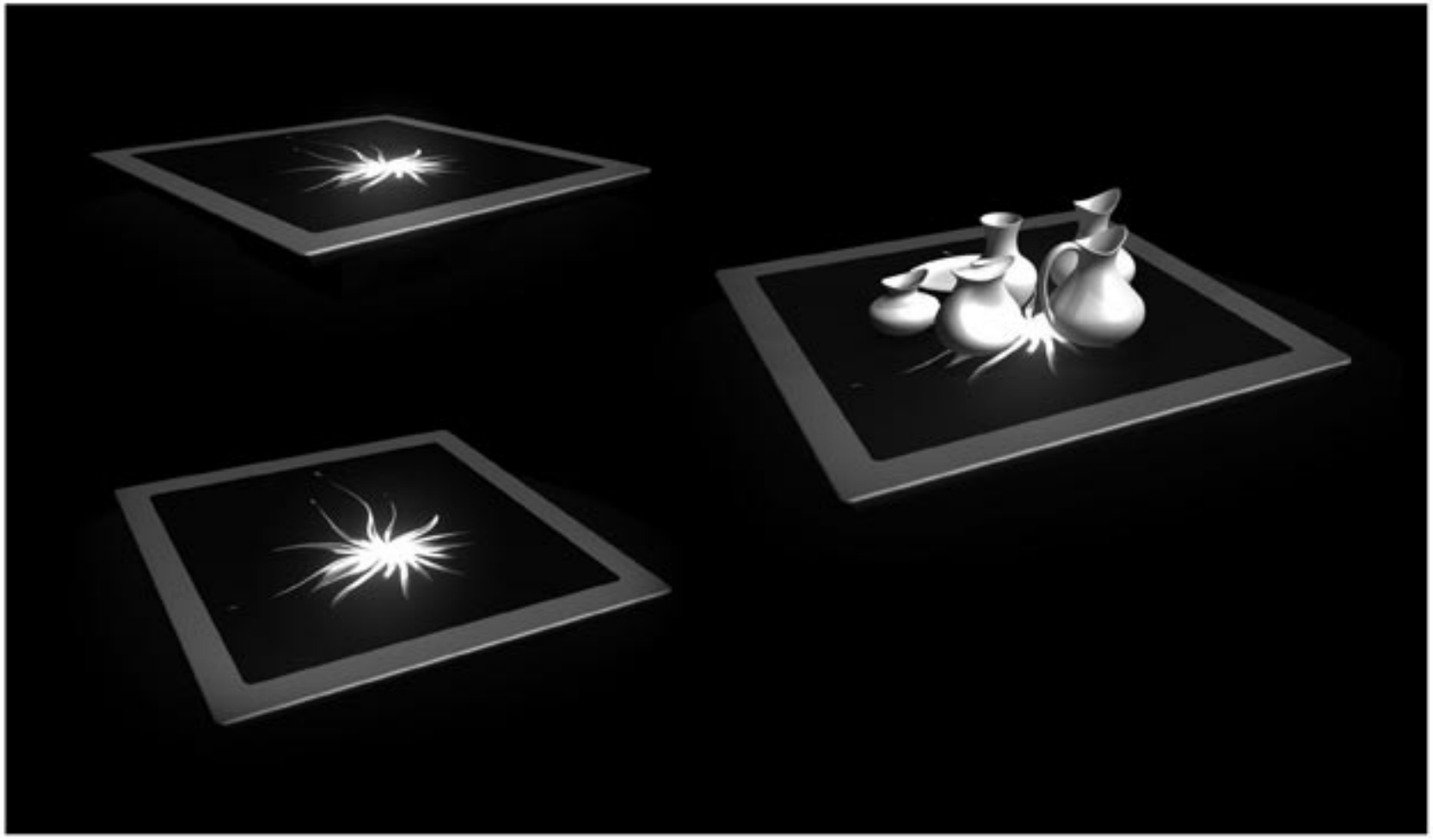

WORKSPACE
1.26076.
15

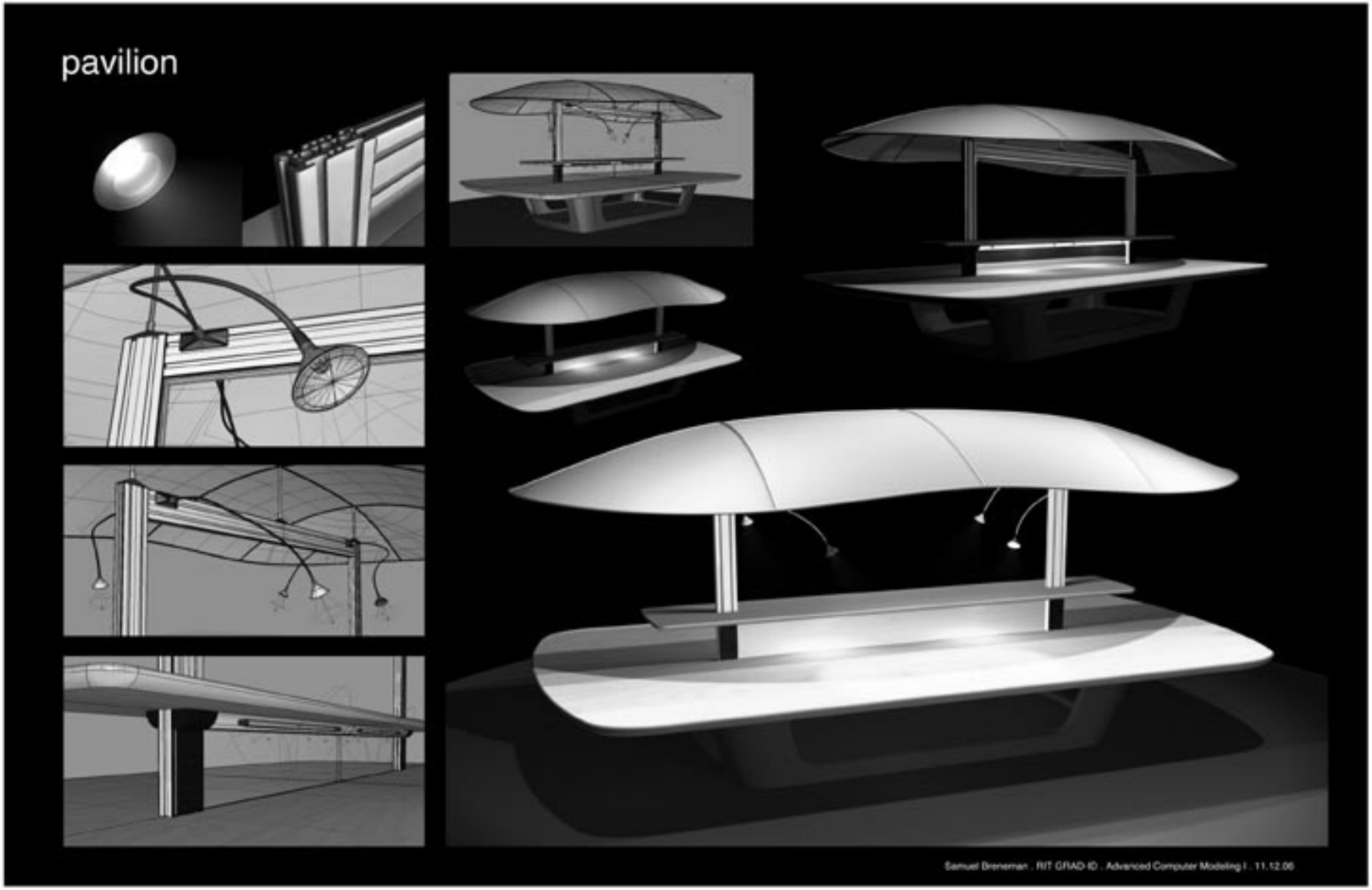

WORKSPACE


WORKSPACE
1.27.07
17


WORKSPACE
1.27.07 S. 18

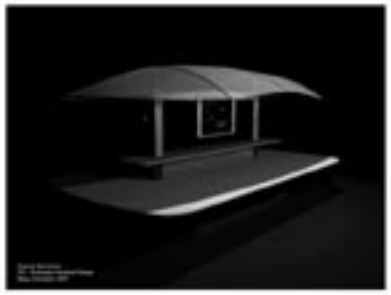
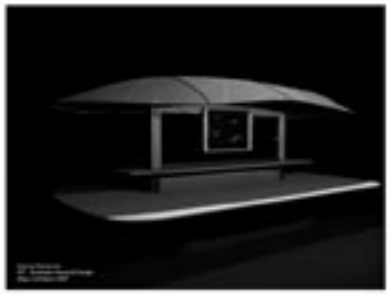
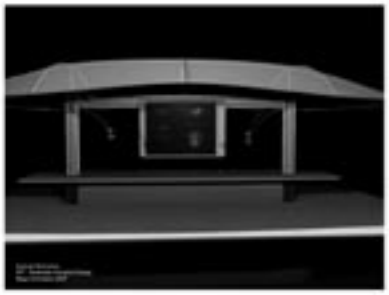
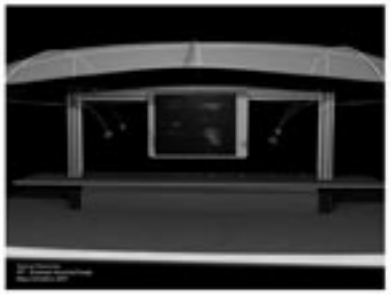
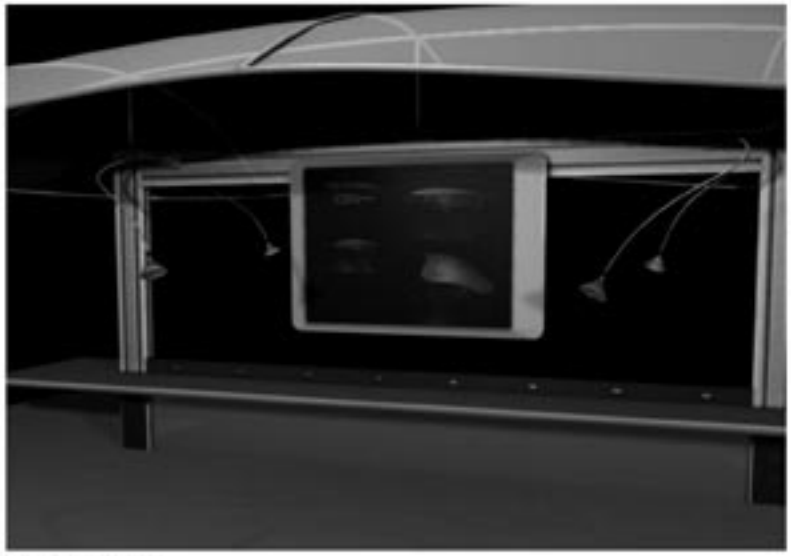
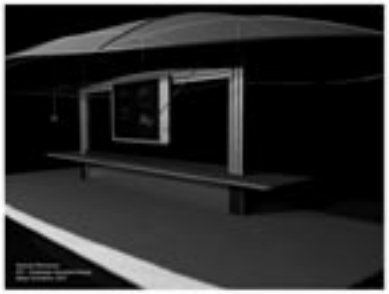
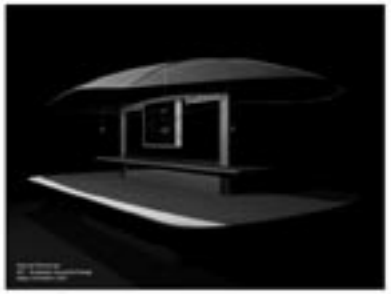

Physical-Virtual Workspaces
pavilion
Physical-Virtual Workspaces
Samuel Breneman RIT · GRAD ID Graduate Thesis Physical-Virtual Workspace 2.12.07




pavilion
Samuel Breneman . RIT GRAD ID . Advanced Computer Modeling I . 11.12.06

Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

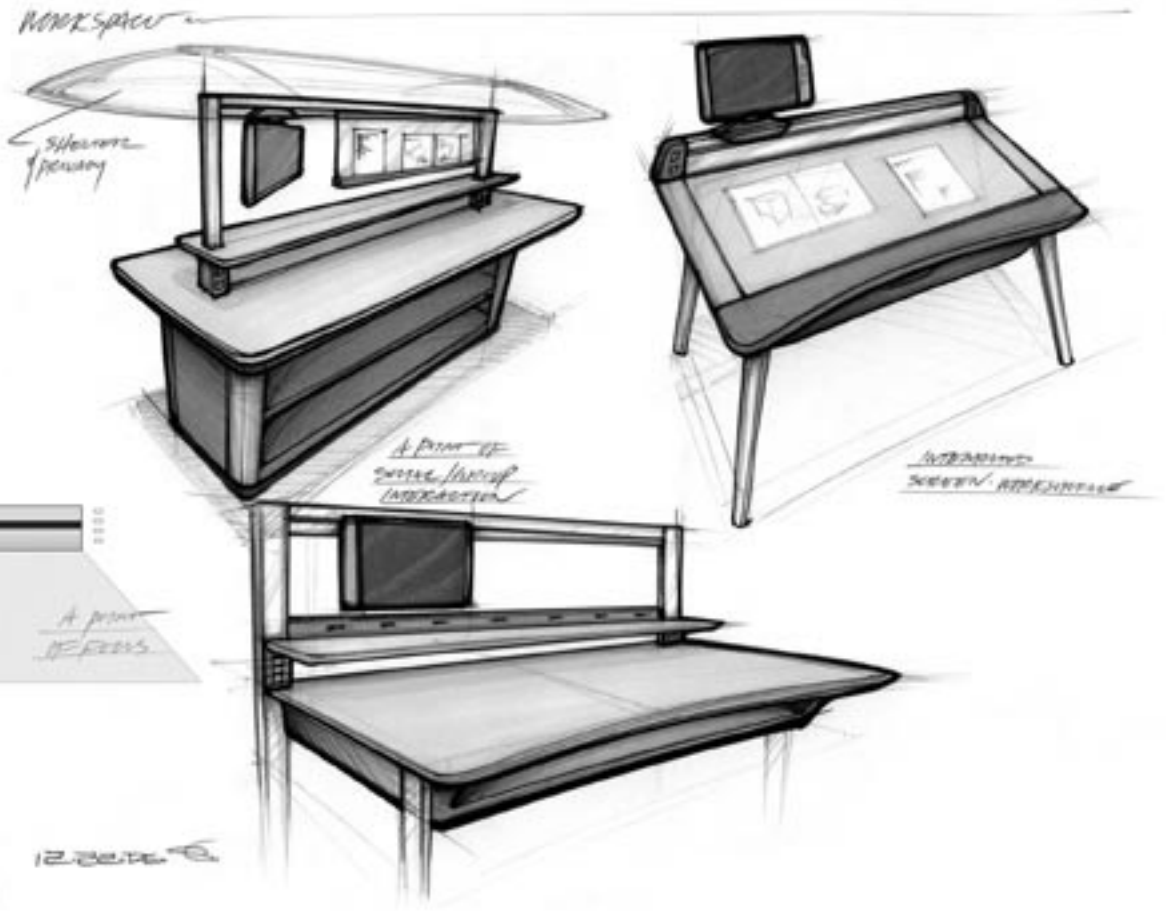
CAD Development...

Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the desk display:

- a moveable touch-screen monitor
- a linked, desk-integrated display
- w/ wireless peripherals for input/output
- desktop power and data ports

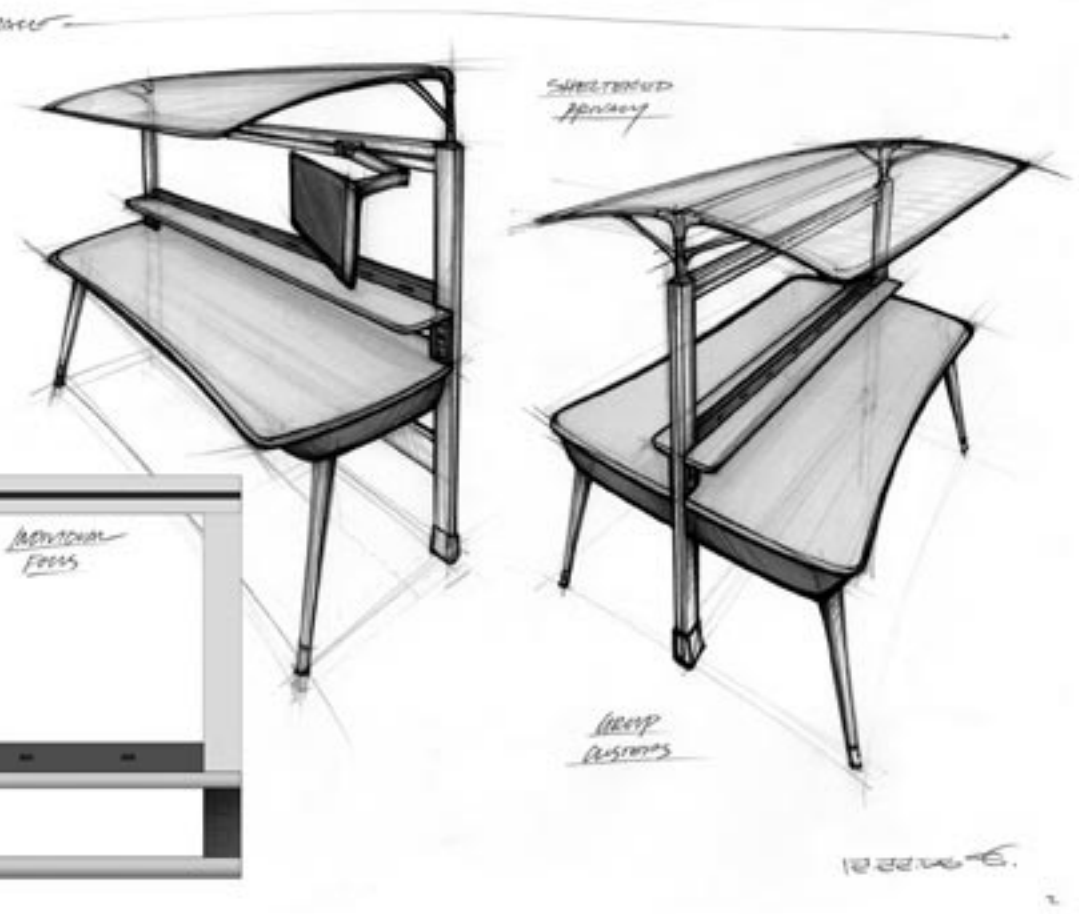


Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

workstation pavilion:

- a modular dynamic display structure
- a removable hanging pc tablet/touch screen
- w/ wireless peripherals
- shelf integrated wireless usb data hub and power
- canopy shade for privacy/shelter and space

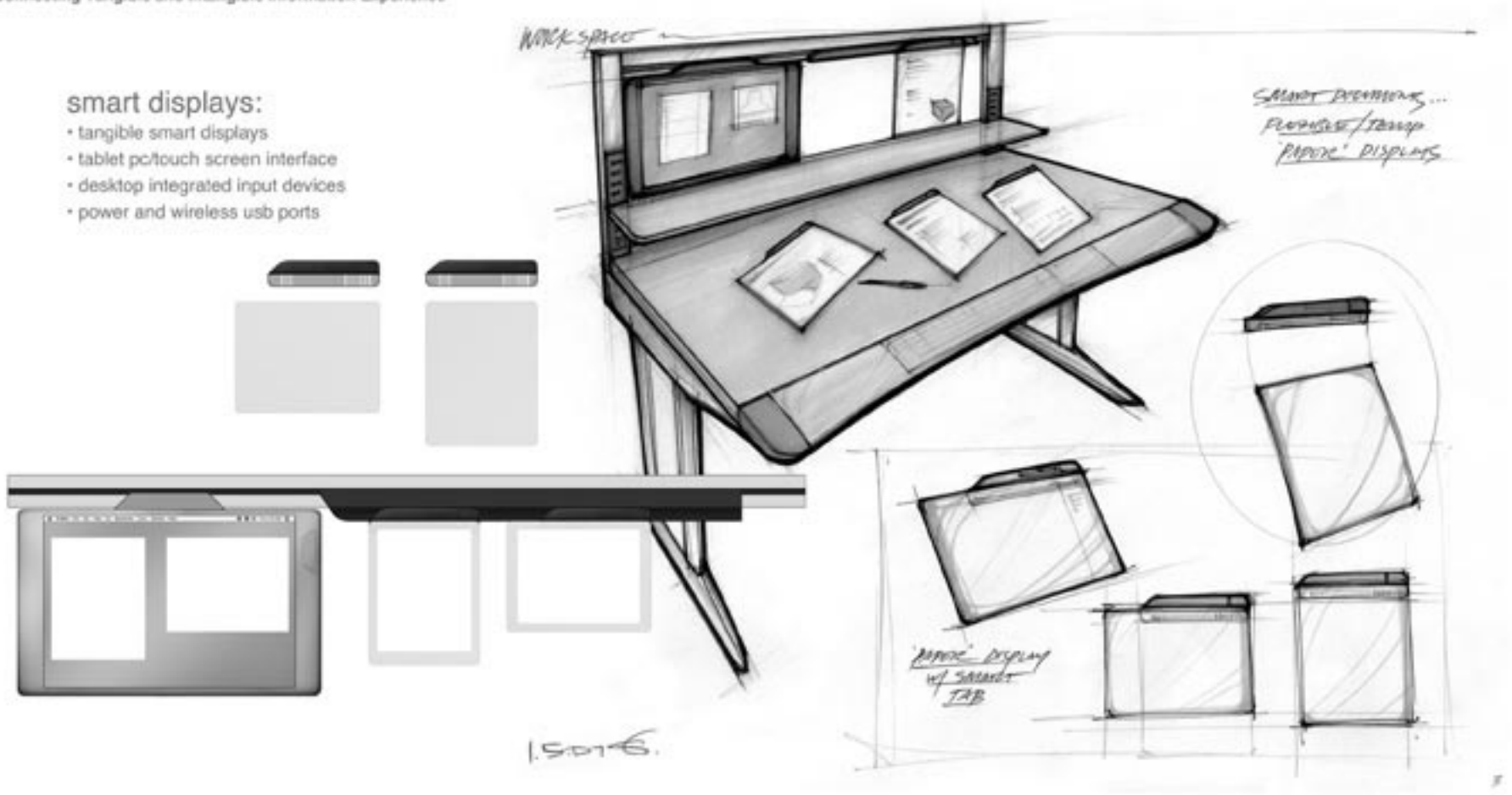


Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

smart displays:

- tangible smart displays
- tablet pc/touch screen interface
- desktop integrated input devices
- power and wireless usb ports

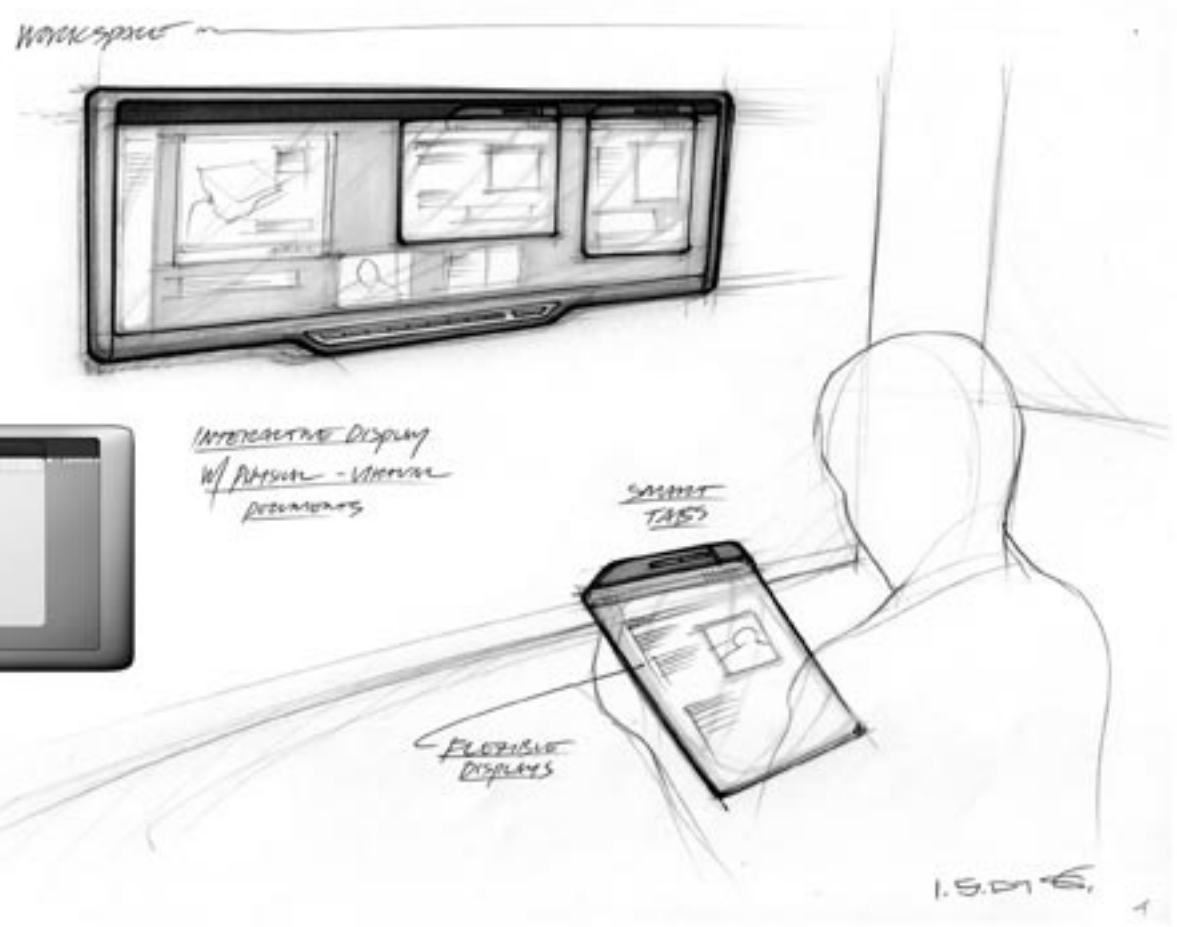


Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the communication board:

- layered information
- a digital touch-screen
- w/ smart displays for 'tangible' digital documents
- networked access to post information

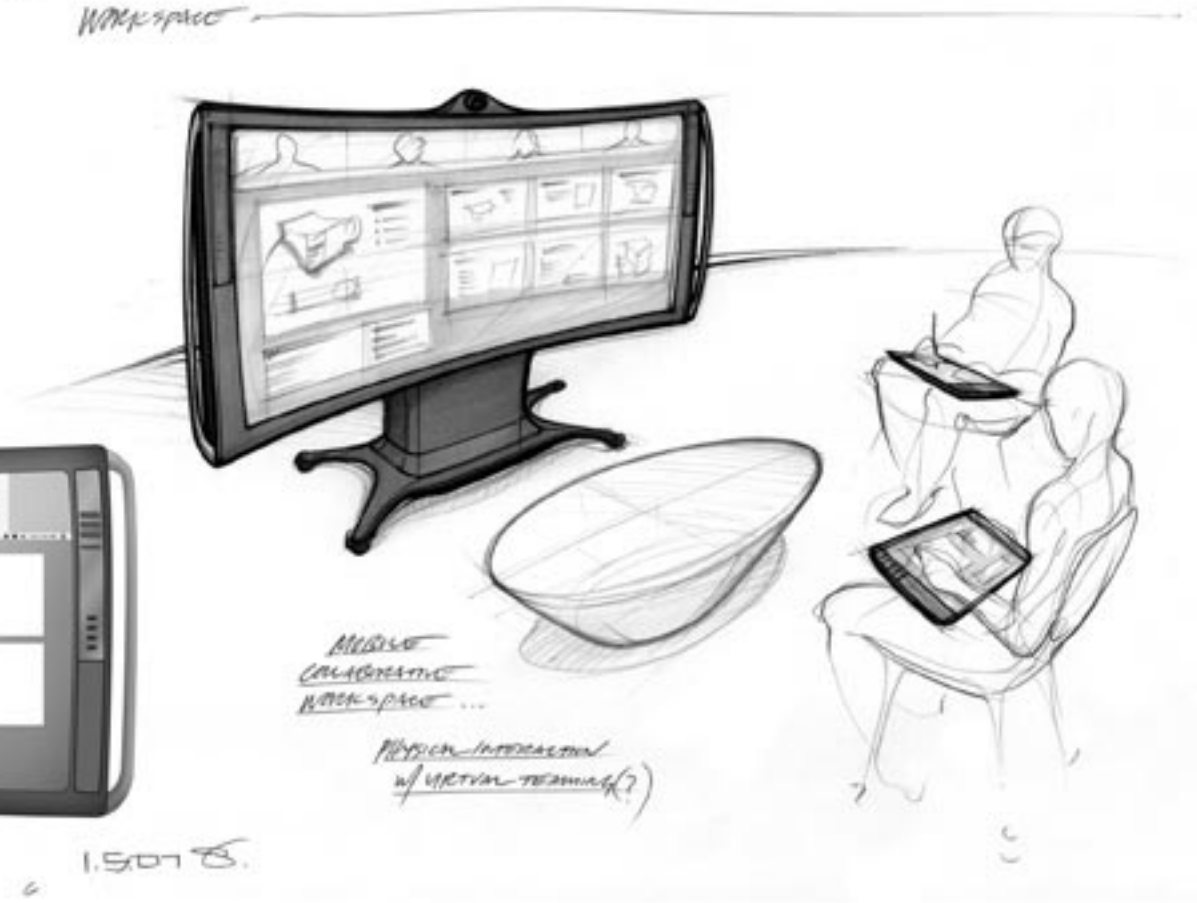


Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the collaborative display:

- a networked team with a collaborative display
- a moveable rear projection touch-screen
- w/ video conference camera
- networked laptop/tablet/handheld inputs

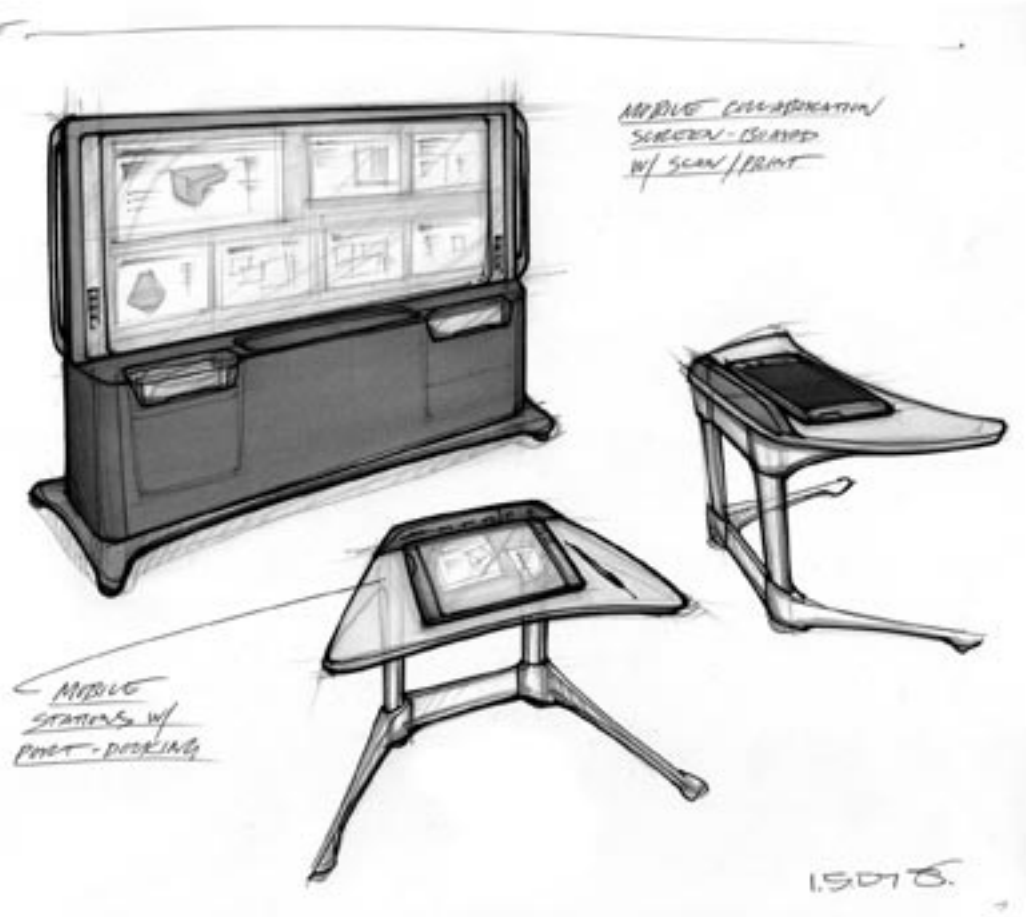


Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the mobile workboard:

- a networked team with a collaborative display
- moveable rear projection touch-screen
- multi-doc scan input and print output
- a goup focused display w/ individual mobile stations
- lightweight configurable stations with port docking



Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the linked workspace:

- RFID tagged documents with embedded info
- w/ reader/encoder for document tracking
- wide format display w/ touch-screen interface
- multi-doc scan input and print output

Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the display interface:

- lightweight workstations with integrated usb dock
- dynamic smart displays with datastrip connector
- adjustable touchscreen display

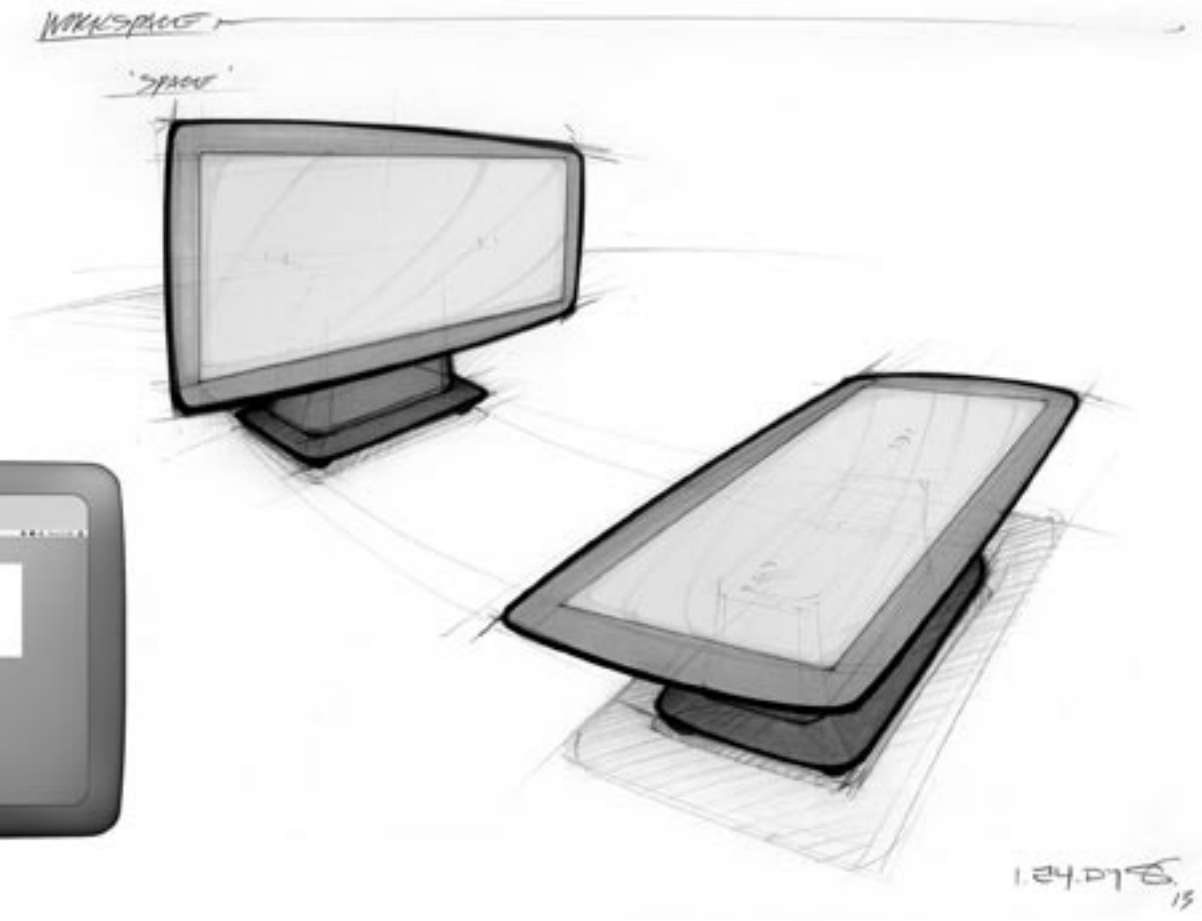
Samuel Breneman RIT - GRAD ID Graduate Thesis *Physical-Virtual Workspace* 2.10.07

Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the adjustable workboard:

- a collaborative display and worksuface
- a multi-input touch-screen interface
- w/ data ports for input and exchange

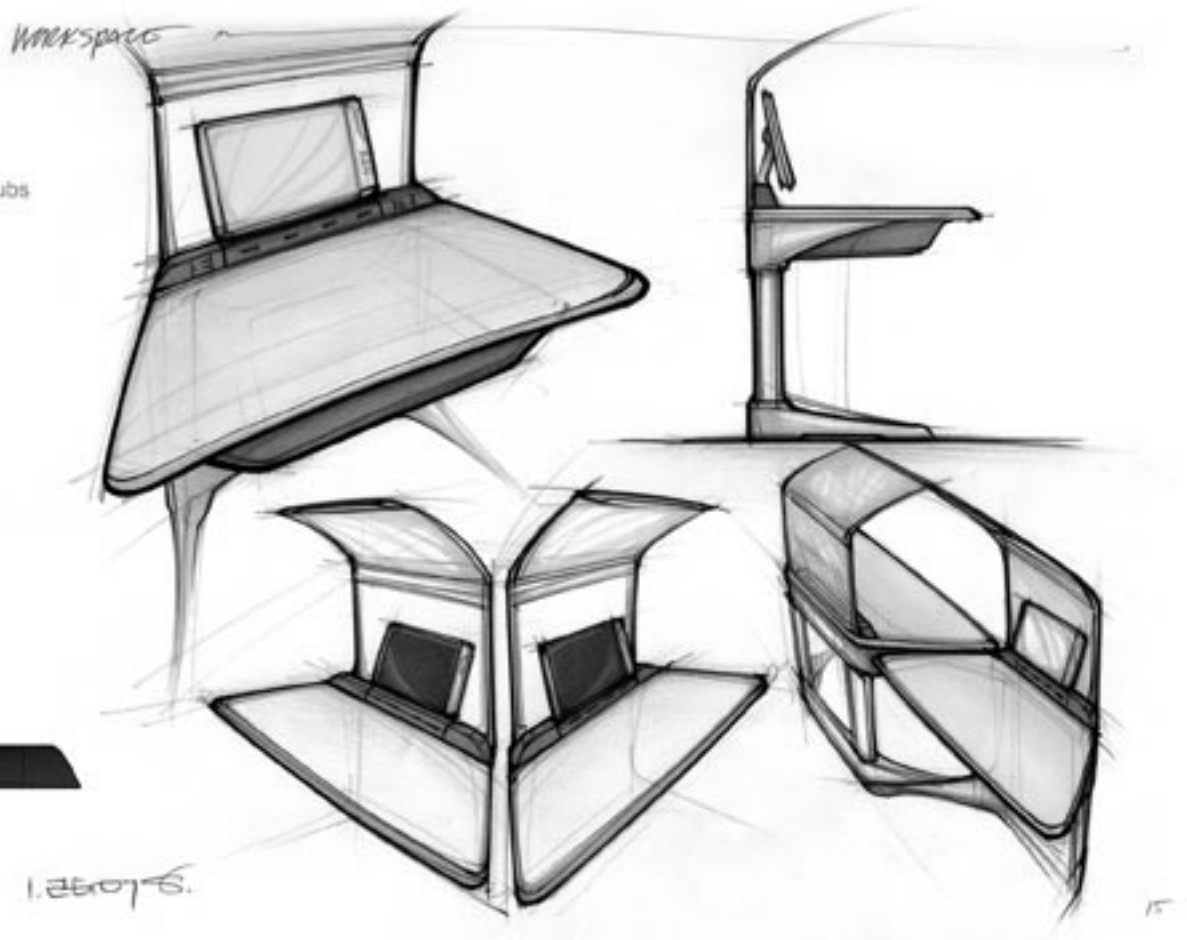


Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the configurable station:

- networked stations create single/group workspace
- lightweight configurable stations with power/data hubs
- touch-screen display w/ wireless peripherals
- screen-backs for lighting and privacy

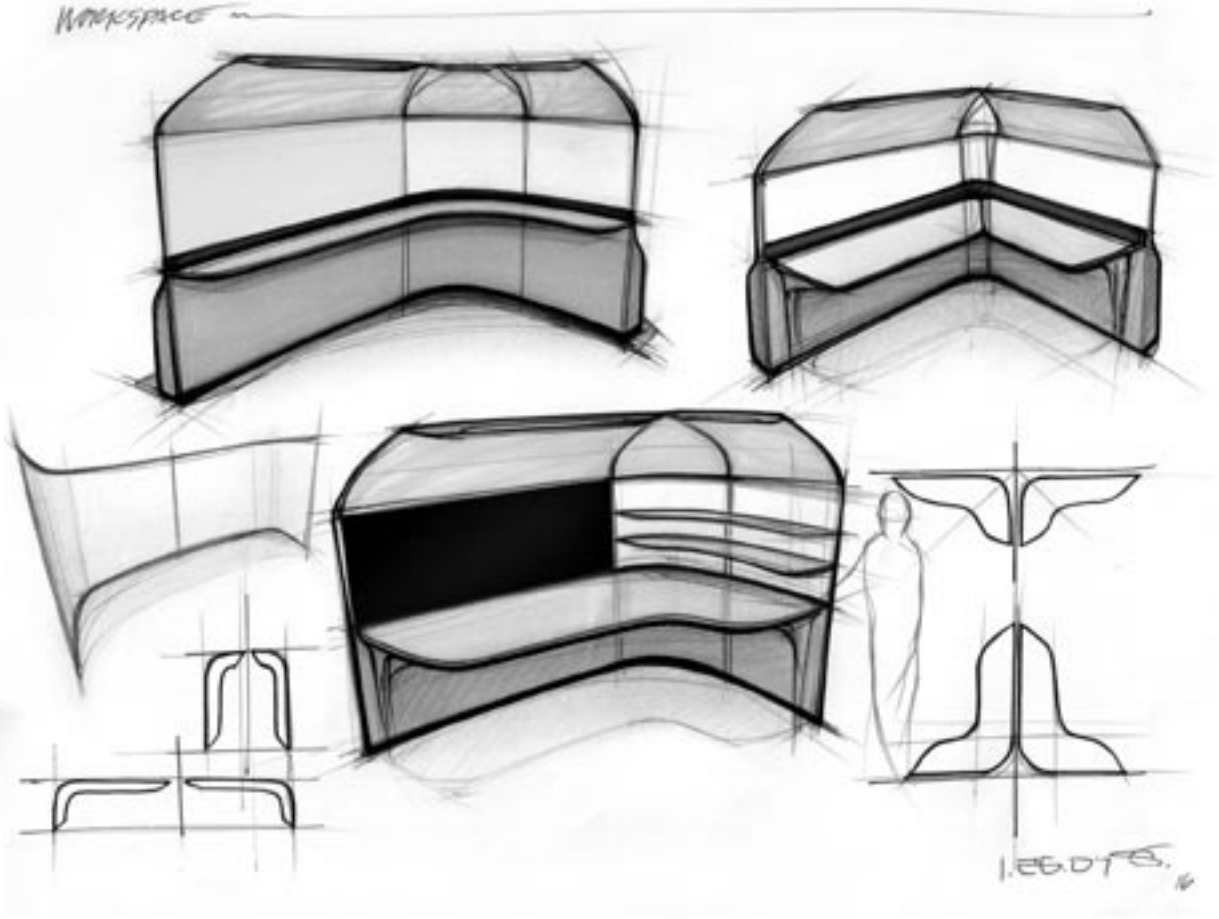


Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the workspace display:

- a workspace integrated wall display
- w/ networked usb data strip
- attachable shelves and worksurfaces
- panel options and screen canopy lighting

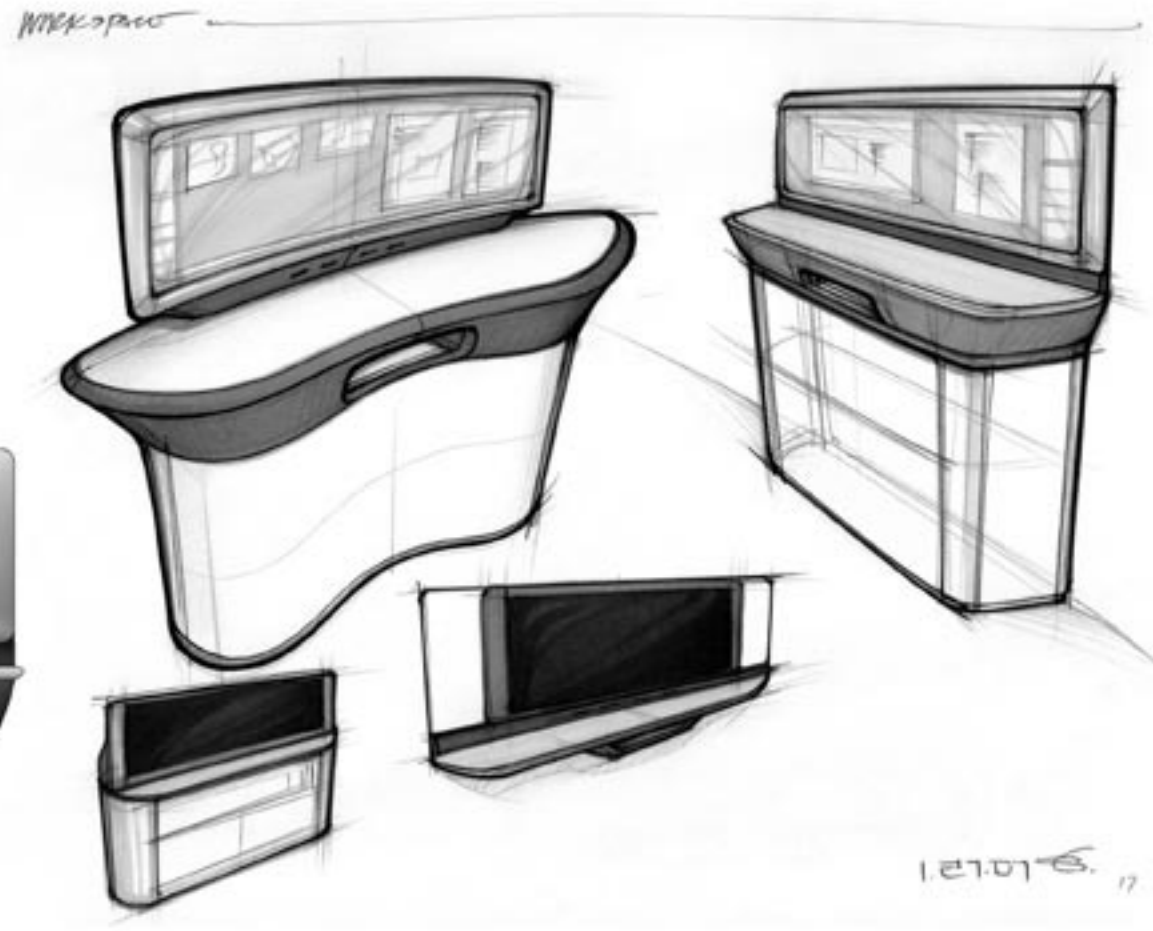


Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

the display bar:

- an interactive touch screen display
- w/ integrated usb data strip
- onscreen controls w/ print output

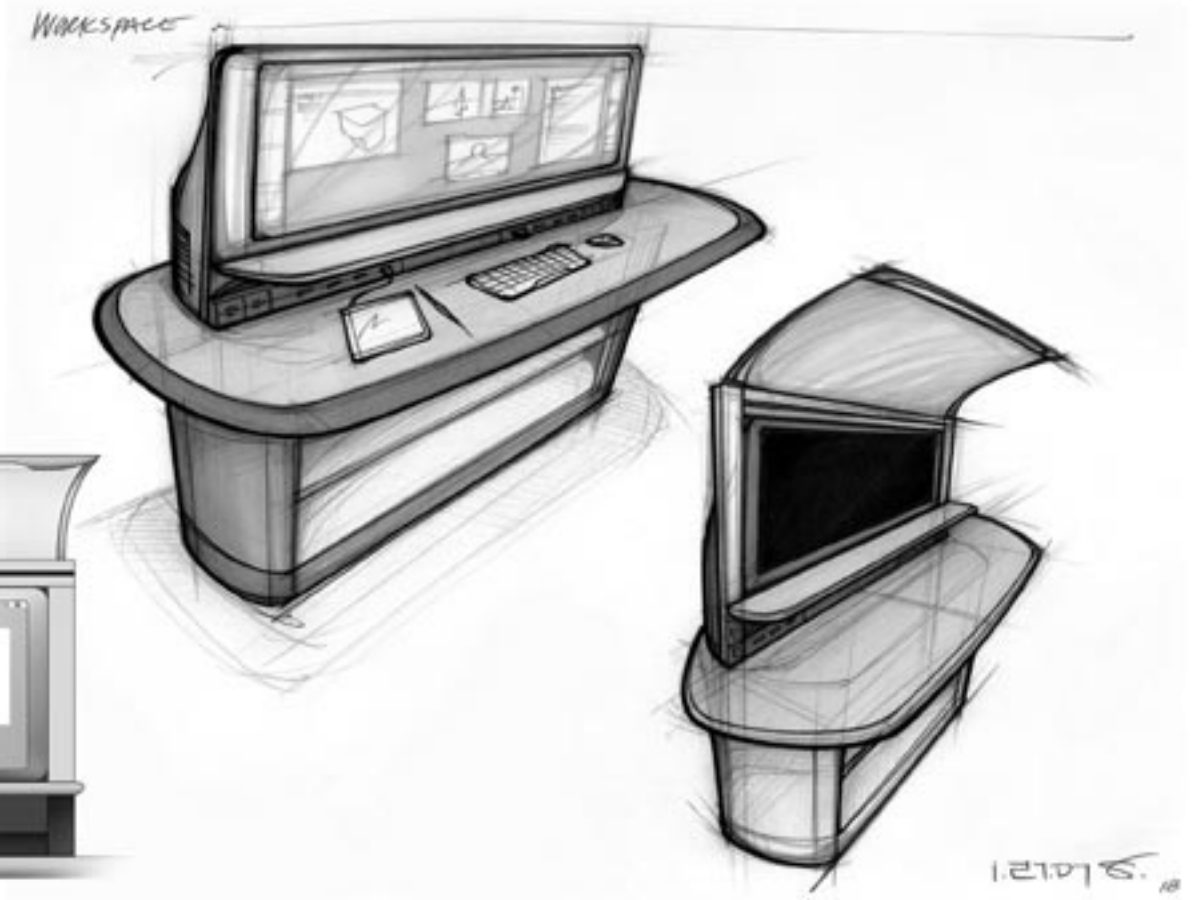


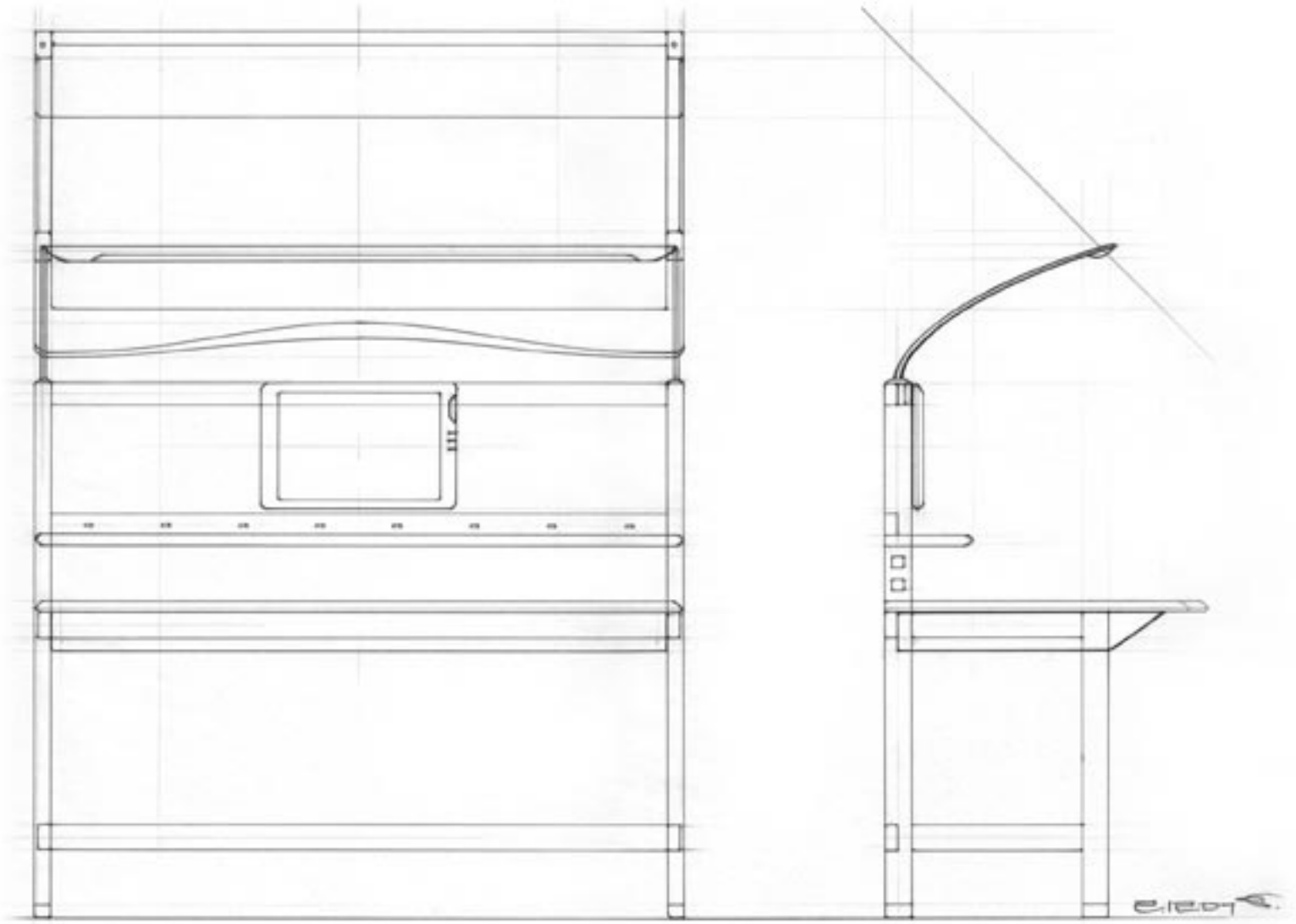
Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

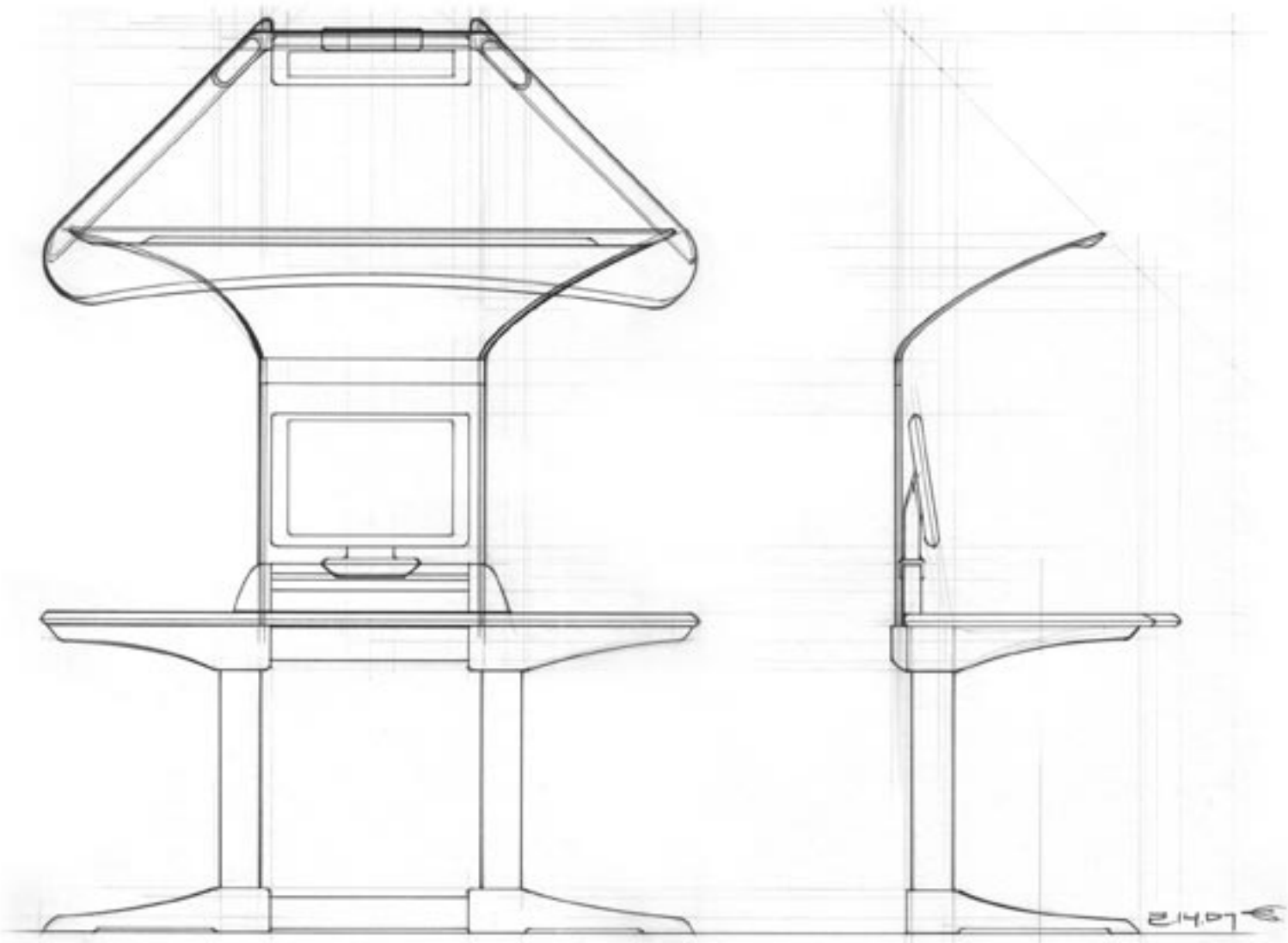
the interactive display:

- an interactive touch screen display
- w/ integrated usb data strip and ac power
- screen canopy w/ lighting

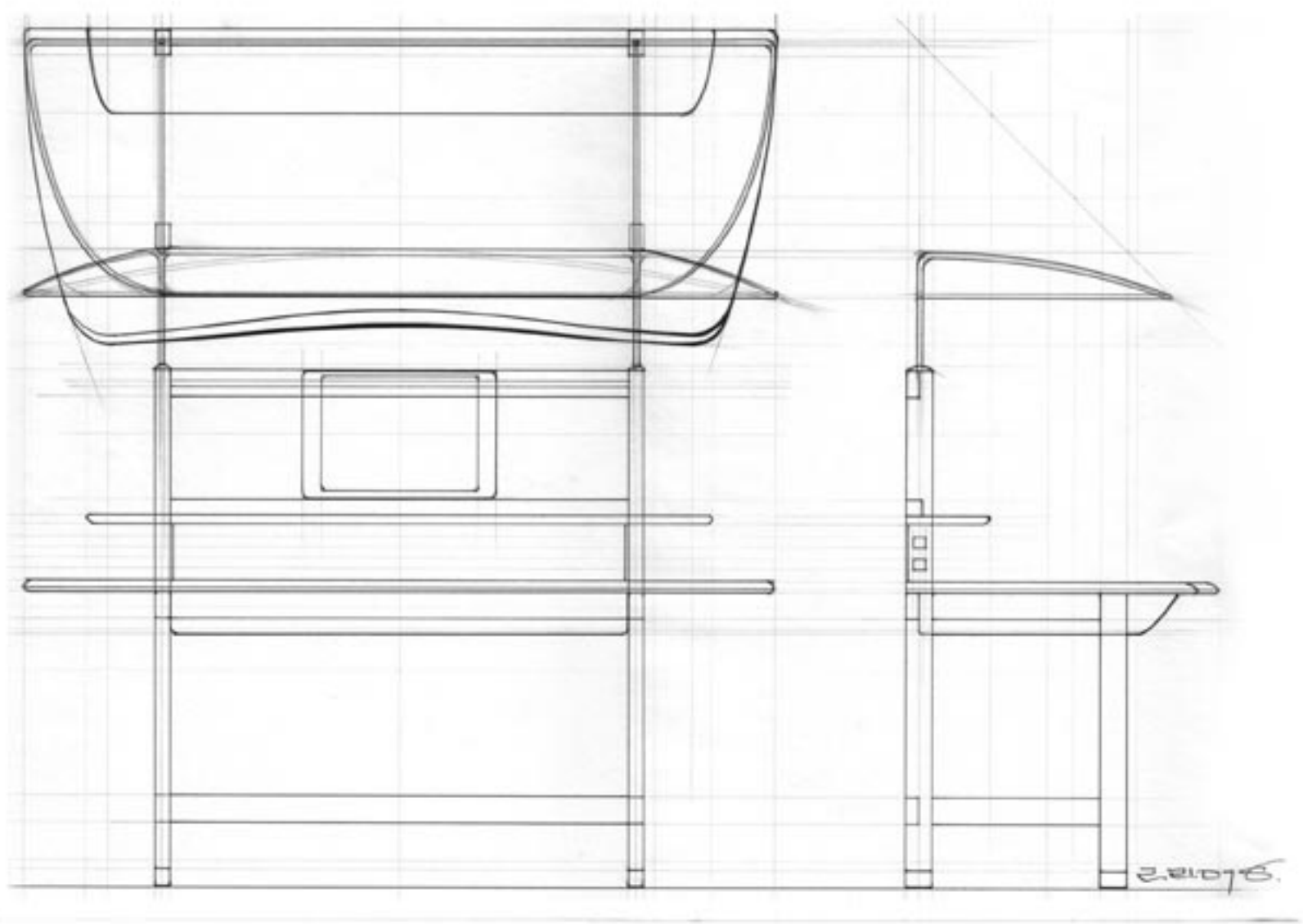




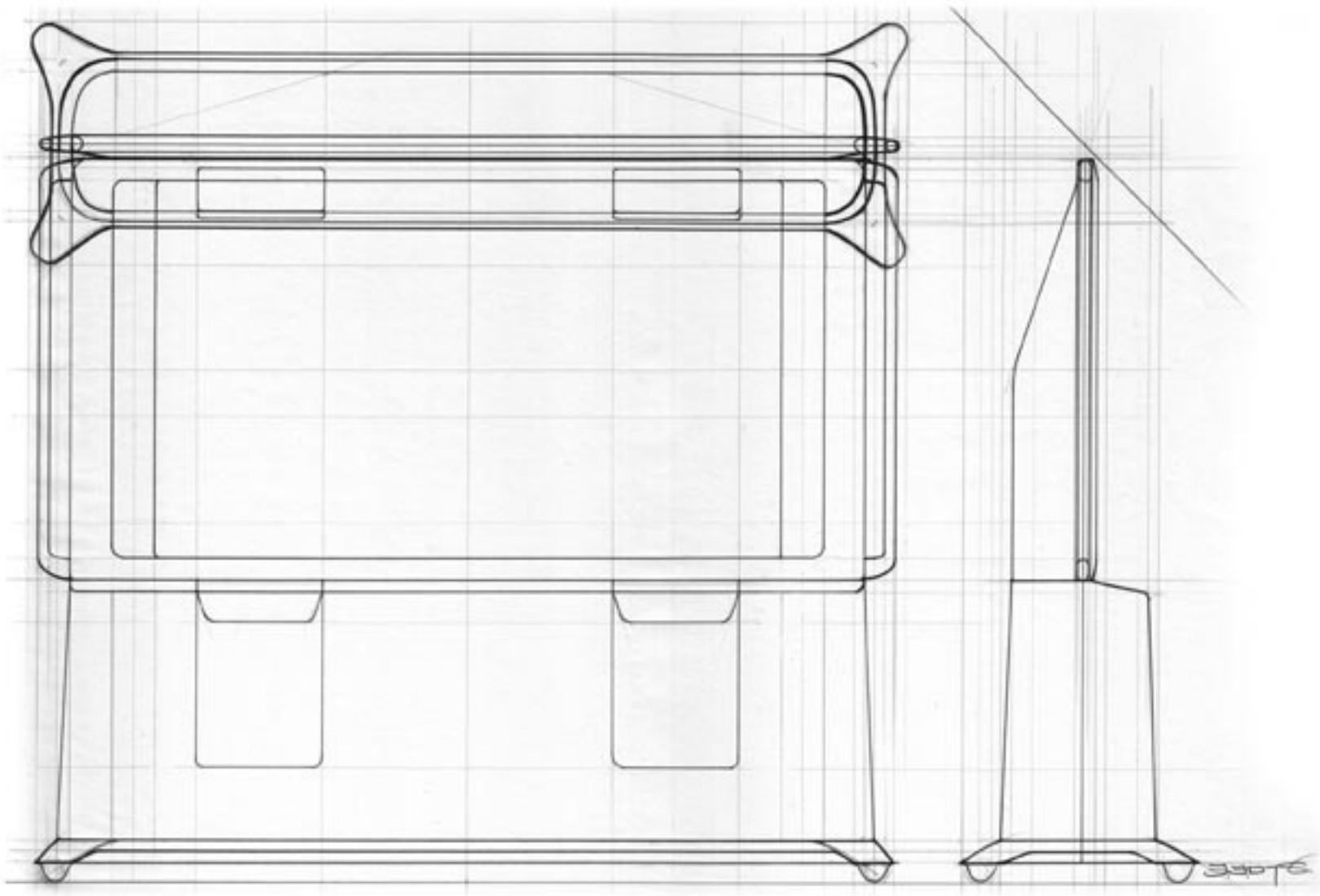
Samuel Breneman RIT - GRAD ID Graduate Thesis *Physical-Virtual Workspace*

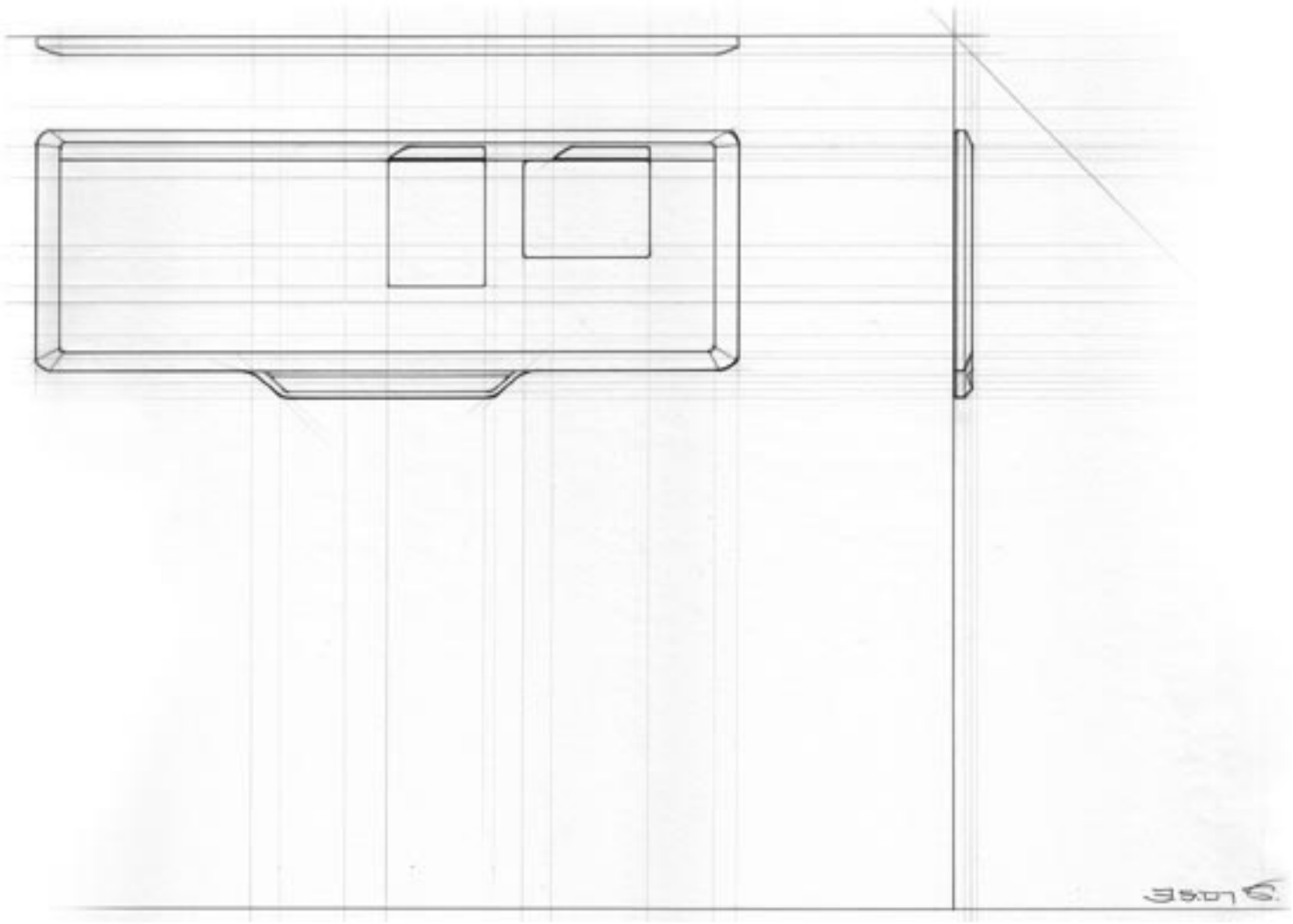


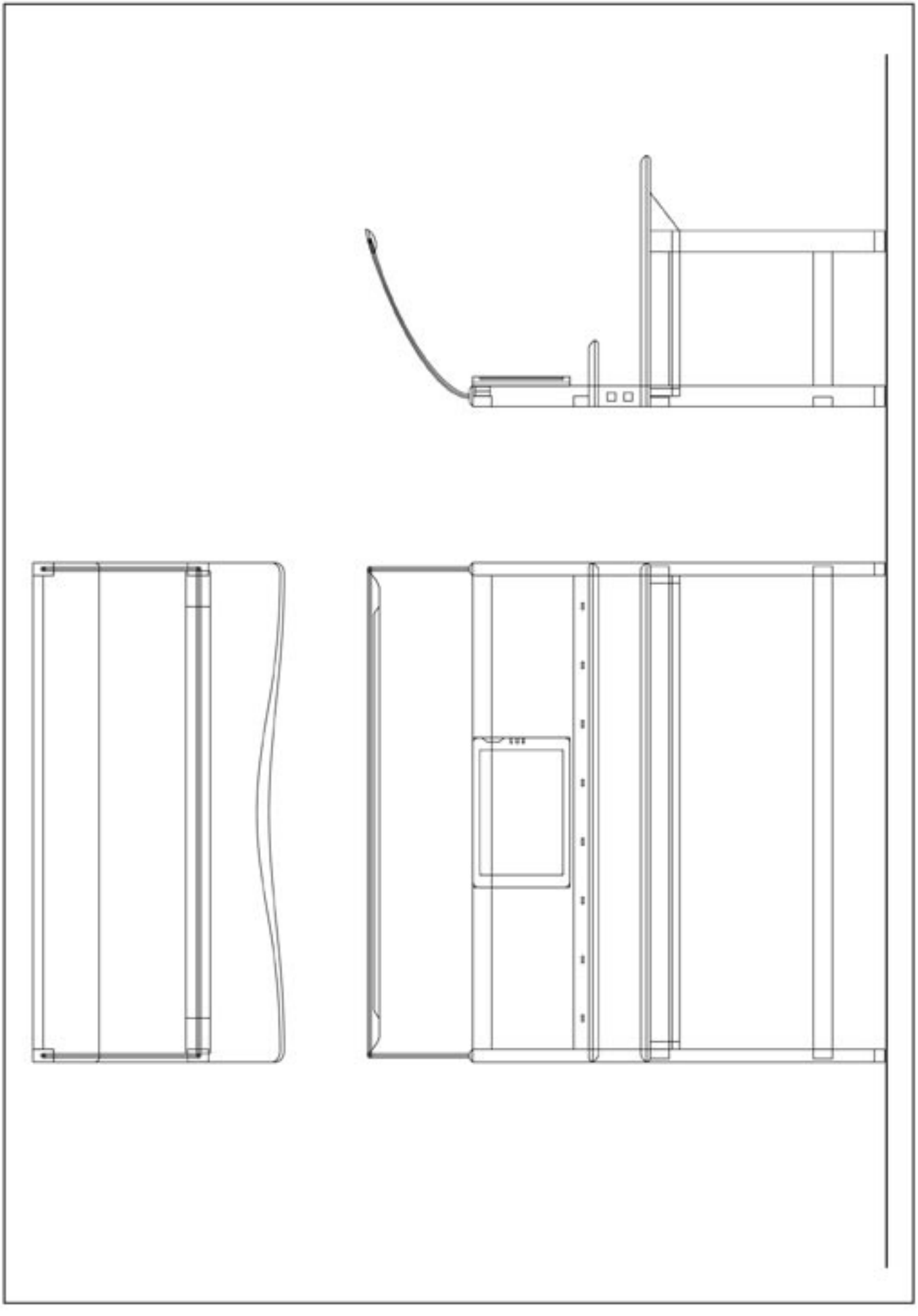
Samuel Breneman RIT - GRAD ID Graduate Thesis *Physical-Virtual Workspace*

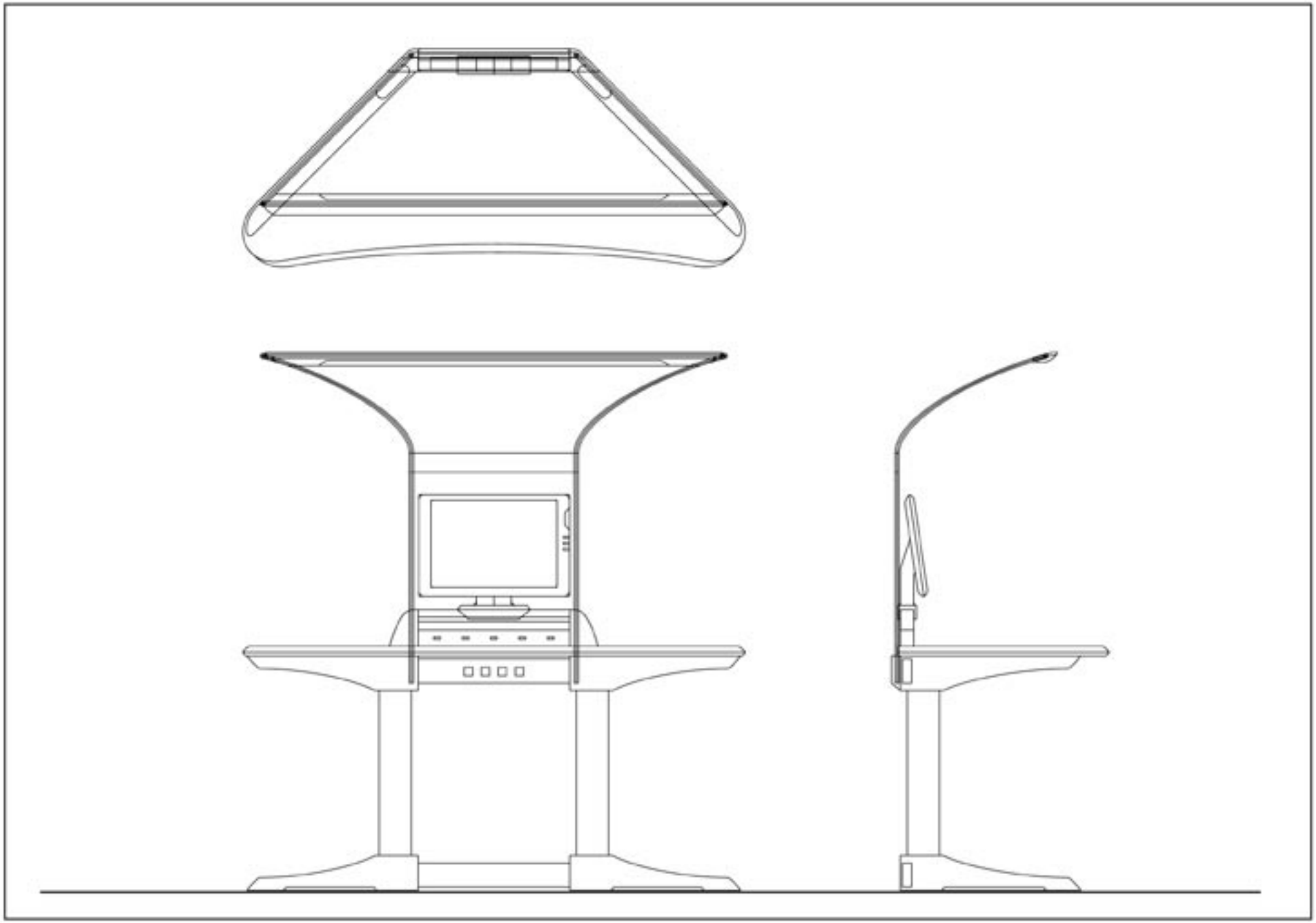


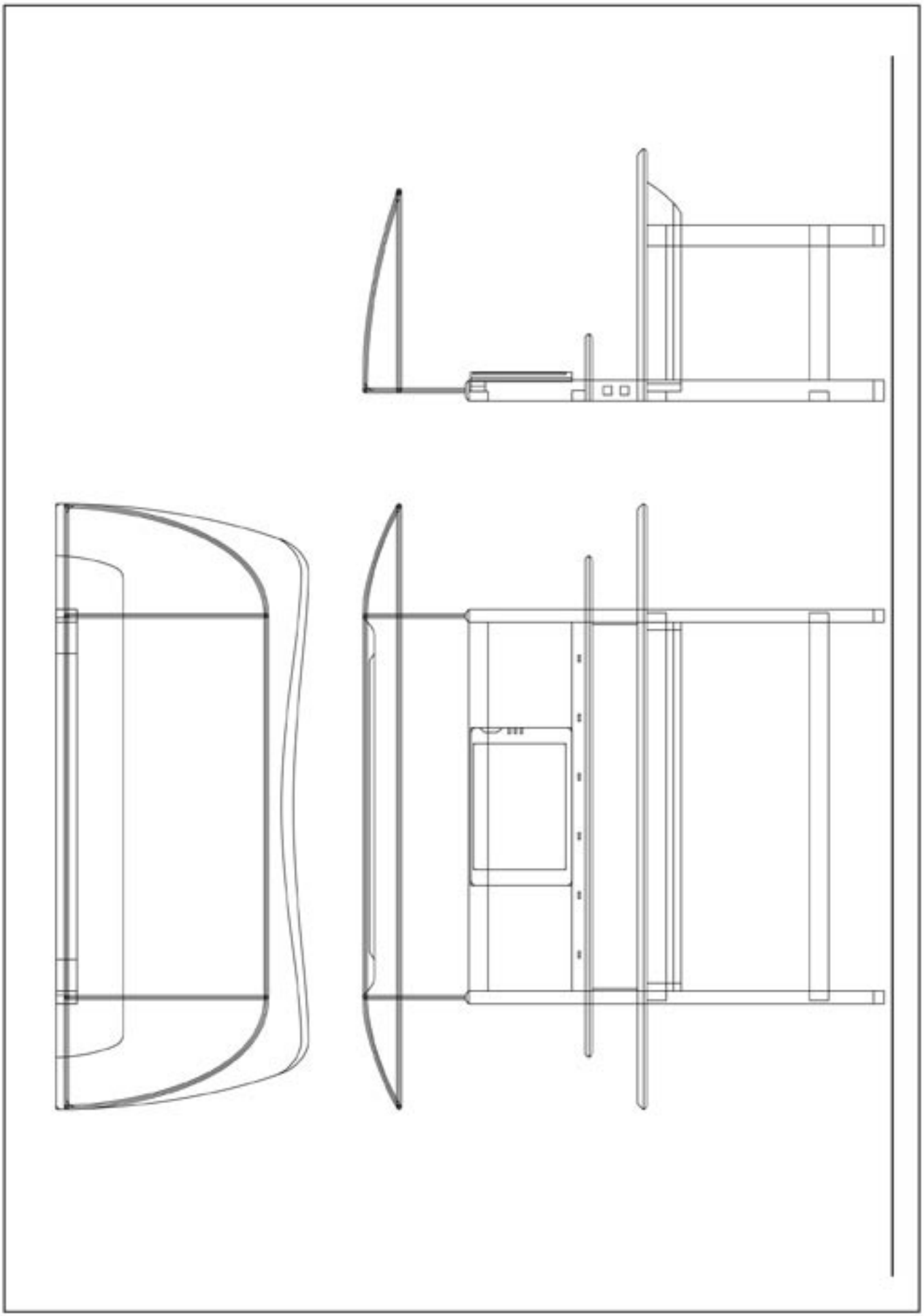
Samuel Breneman RIT - GRAD ID Graduate Thesis *Physical-Virtual Workspace*

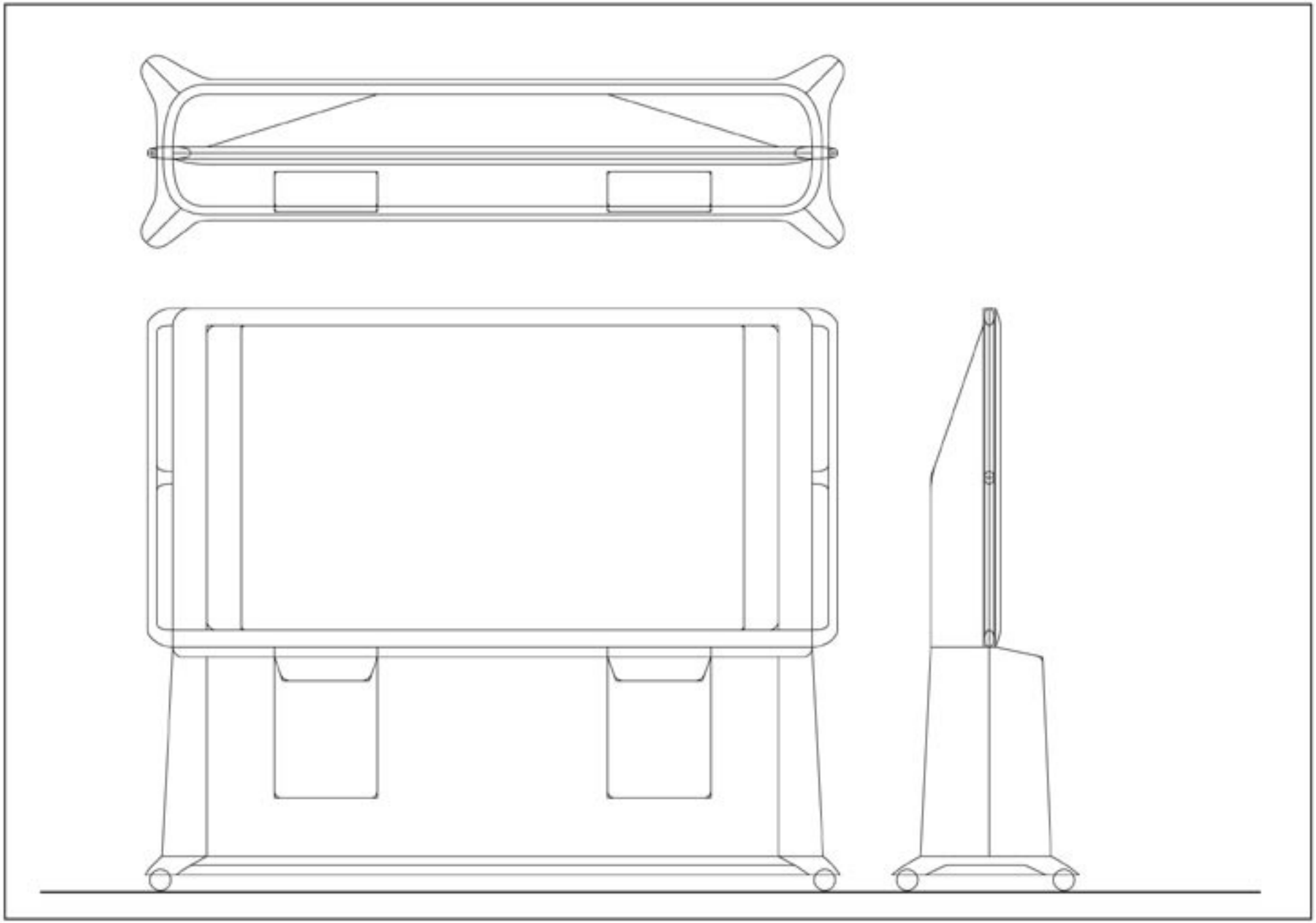


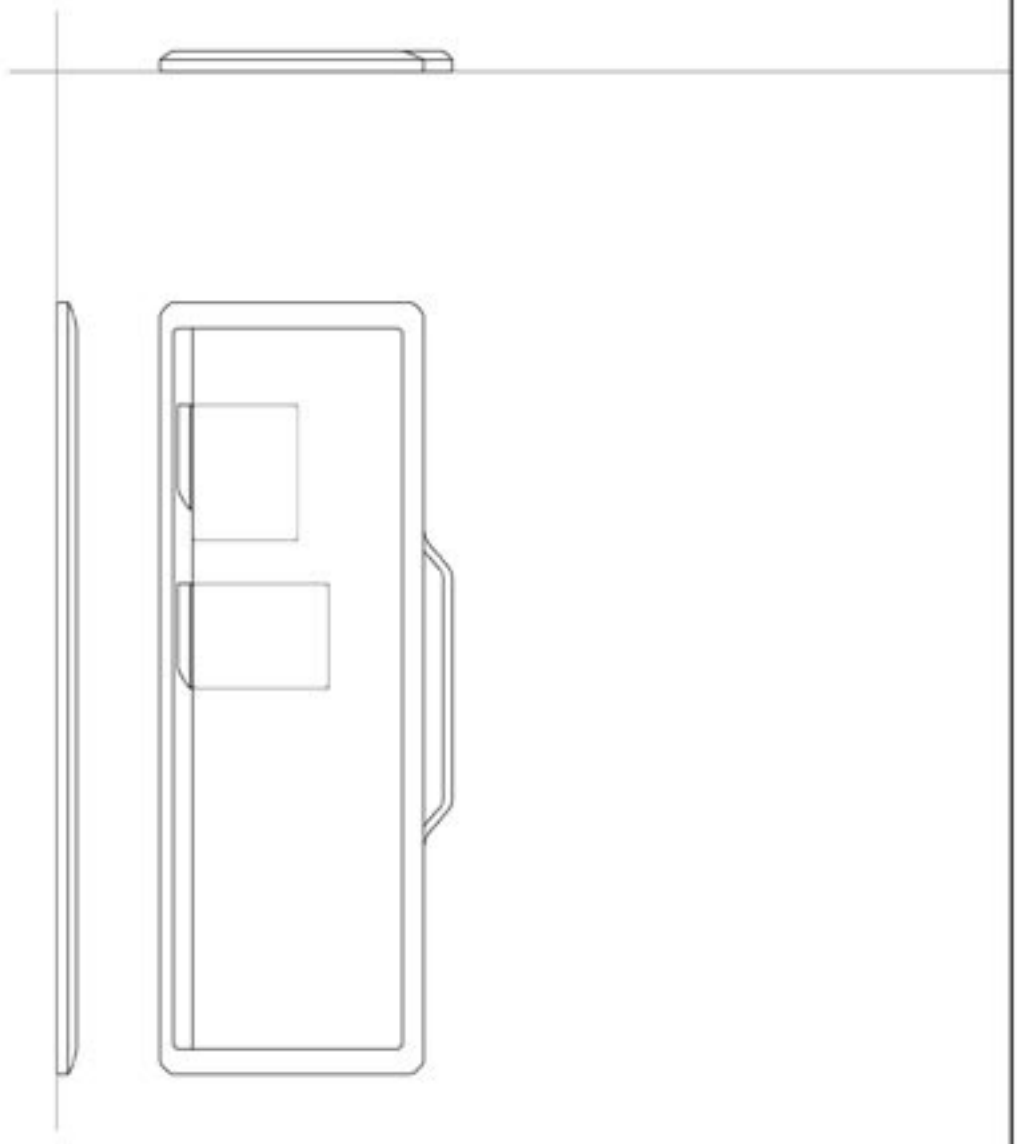




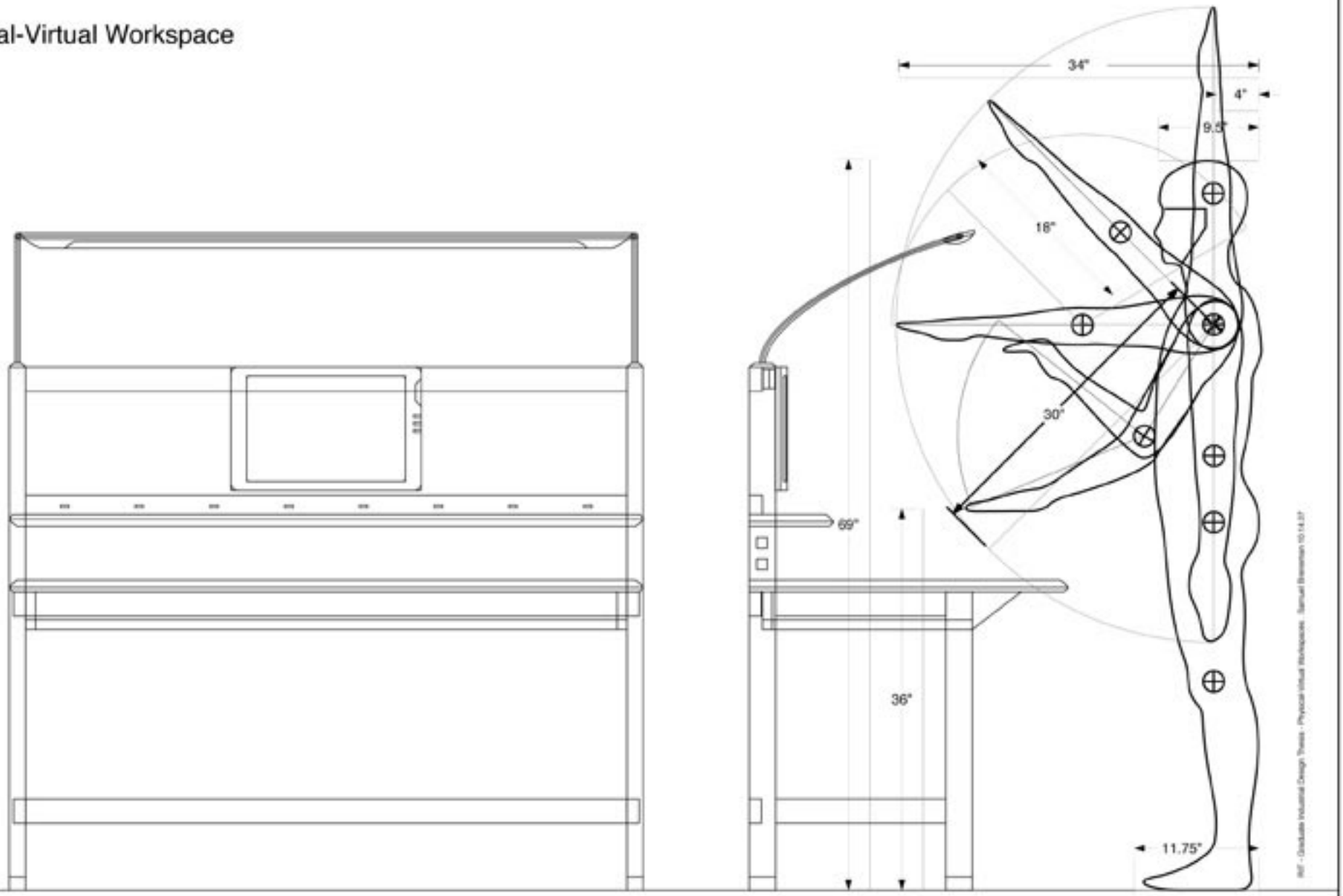




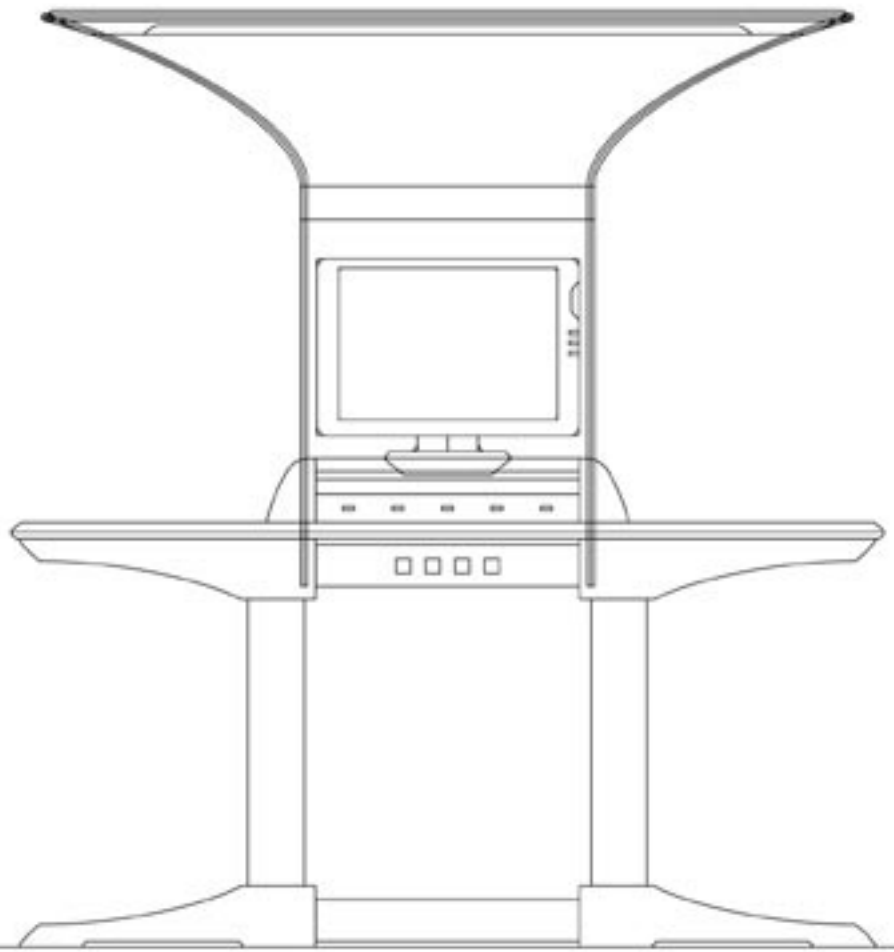


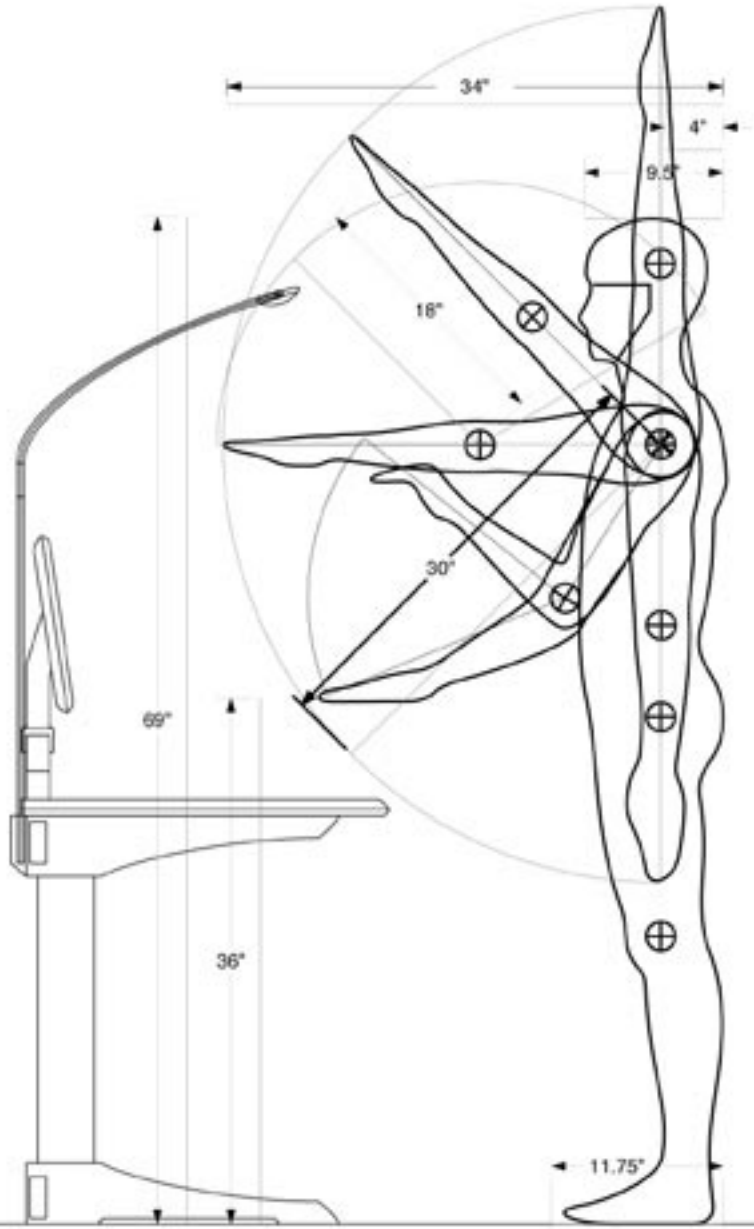


Physical-Virtual Workspace

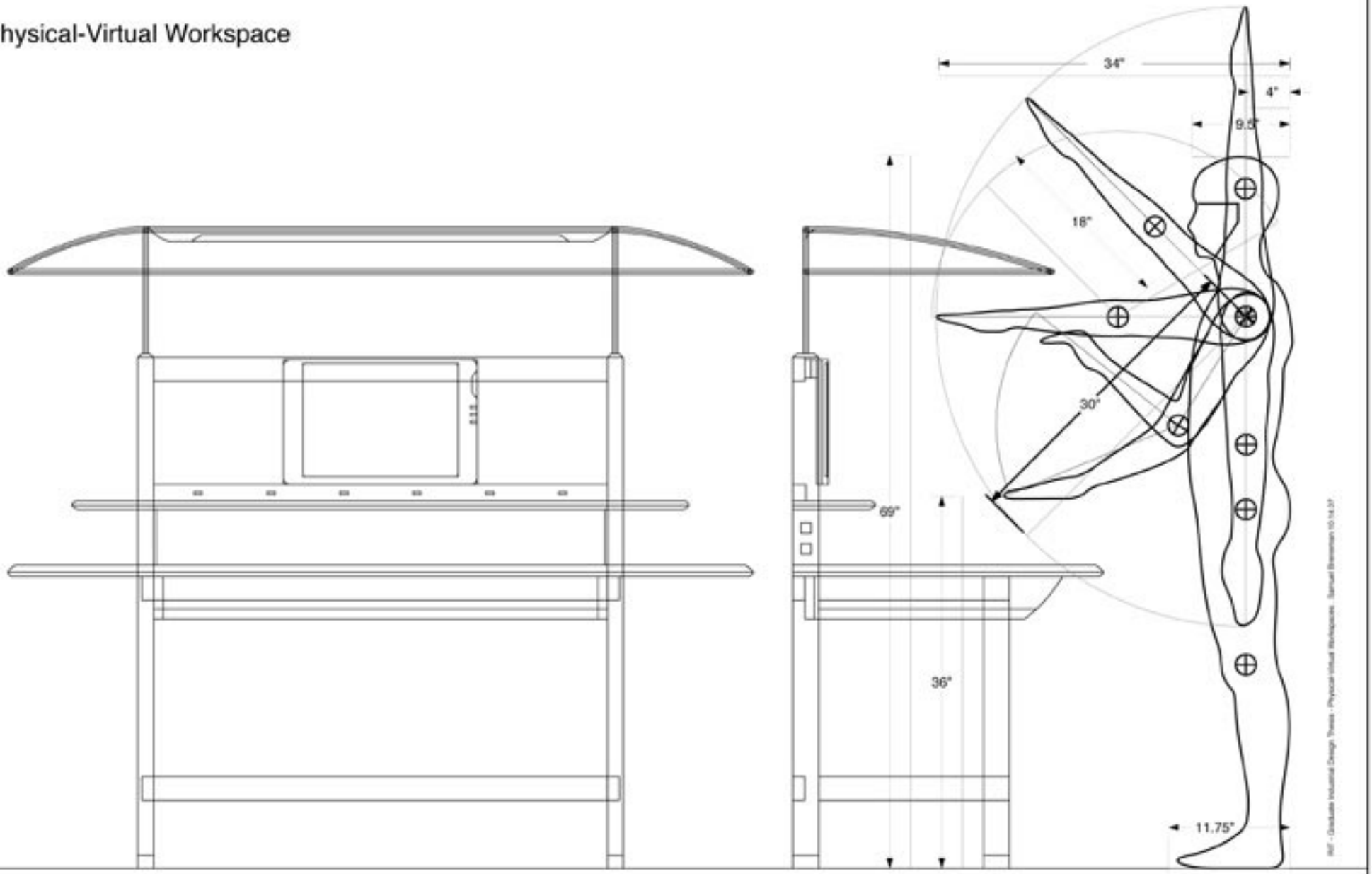


Physical-Virtual Workspace

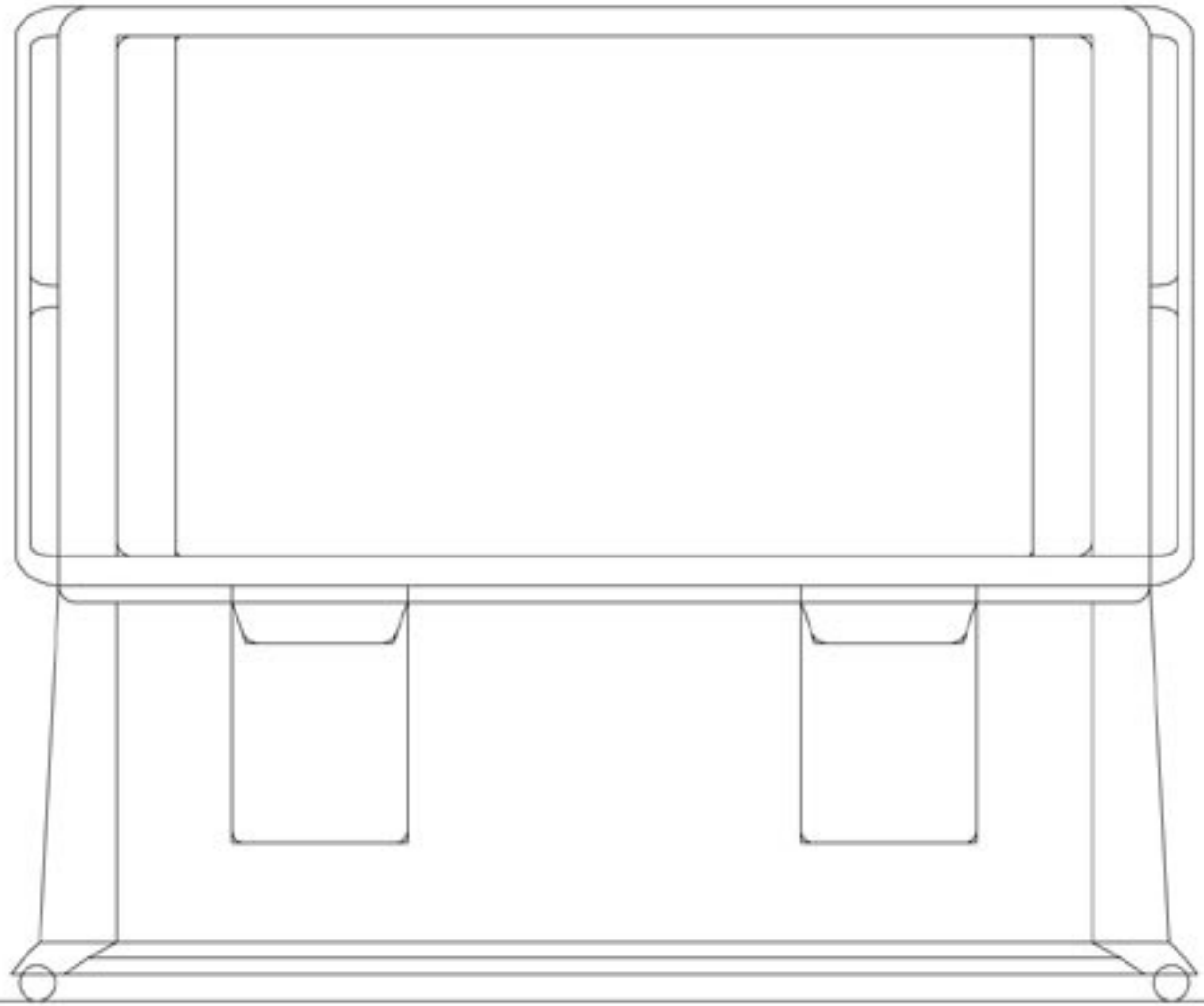


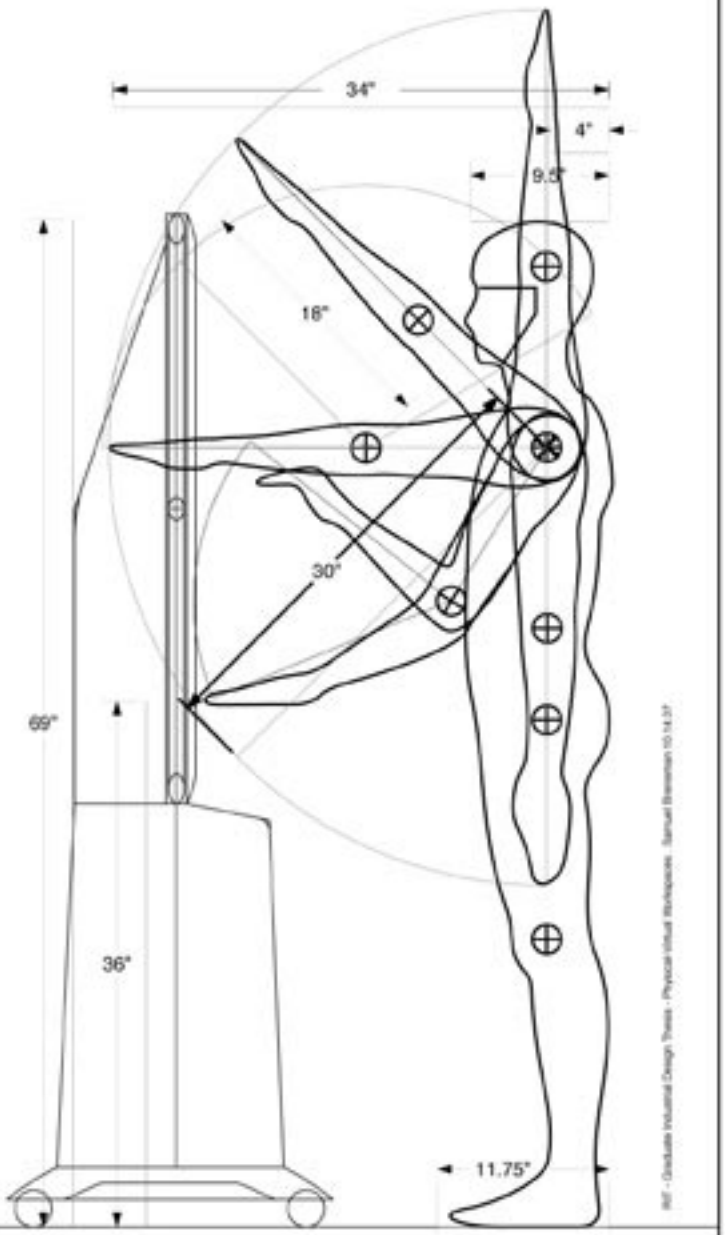


Physical-Virtual Workspace

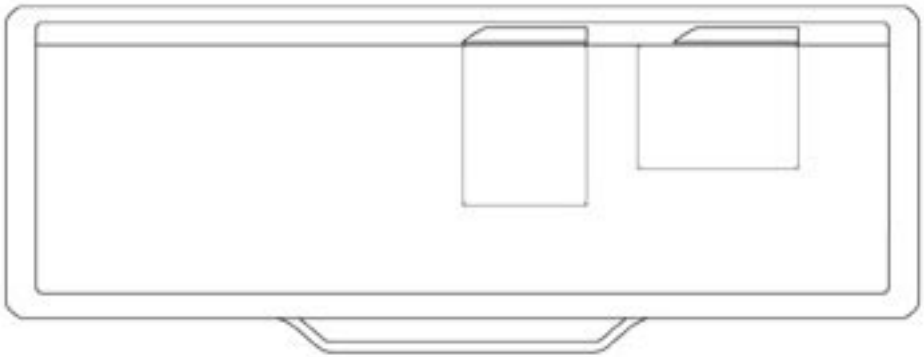


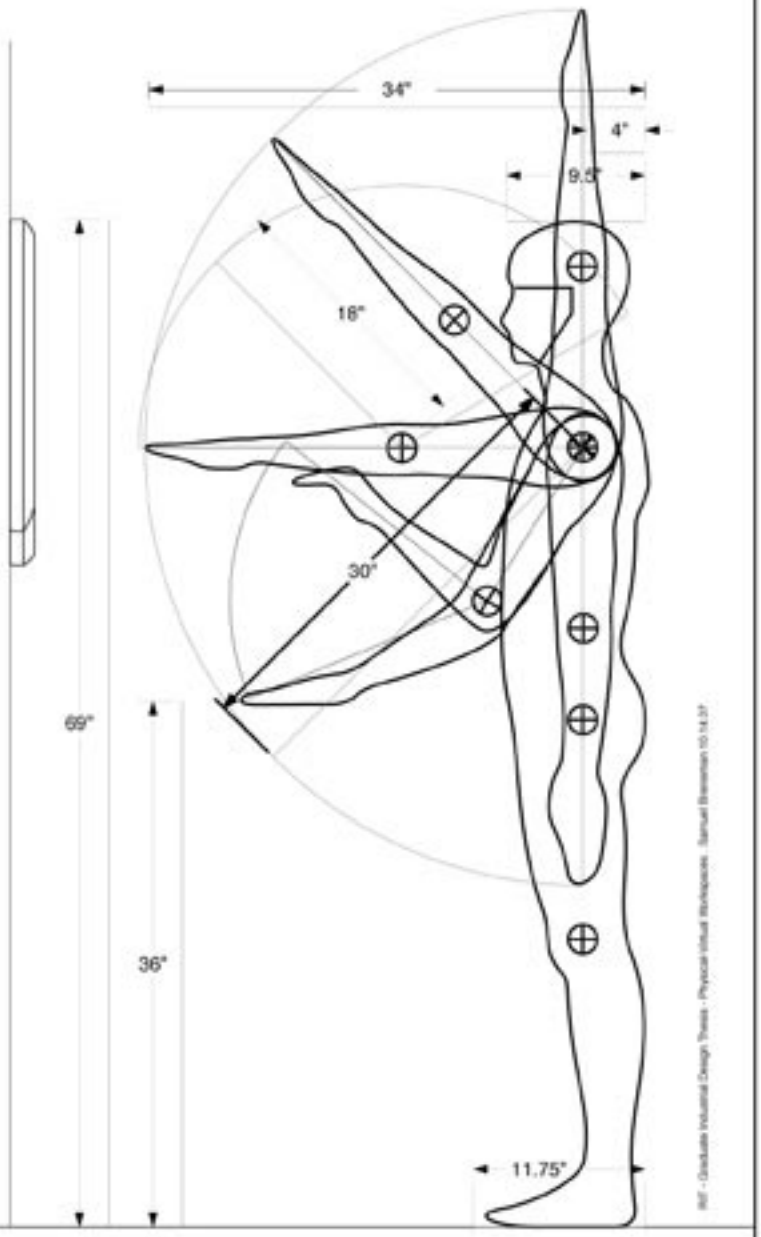
Physical-Virtual Workspace



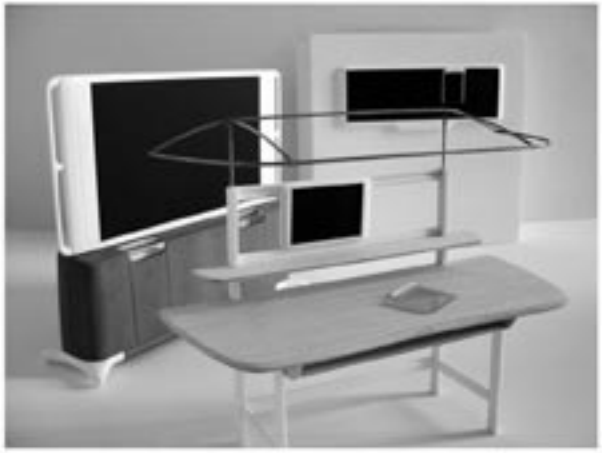


Physical-Virtual Workspace





Physical-Virtual Workspace






the workspace system

The combined physical-virtual workspace design concepts form an interactive product system whose individual parts function collectively as a synthesized whole. The design of the space and its environment provides structure and support for users to think and work in both physical and virtual mediums of information and experience.

Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

Graduate Industrial Design
Rochester Institute of Technology
Samuel Breneman
RIT - ID Graduate Thesis
Physical-Virtual Workspace

Connecting Physical and Virtual mediums

From a product design standpoint, we are encountering demands for solutions that exist between hard and soft mediums, and there is a need for workspaces that can support and connect both the physical and virtual development of such ideas. These hybrid products are bridging a gap between our physical and virtual experiences and creating new challenges as well as new solutions. In essence, they are serving to connect the tangible and the intangible aspects of our lives.

My thesis is focused on the connection between the physical and virtual mediums of information and experience. I hope to explore the workspace as a stage for composing such creative content that includes aspects which are both tangible and intangible. The design explorations will consider the balanced relationship of user experience and social interaction within the working space where intangible ideas are transformed into a tangible reality.

The goal is to develop a creative workspace that can be used to form and develop new ideas. The supportive stage would provide the space and means for accessing and manipulating both physical and virtual content serving as an integrated interface allowing users the ability to fluidly express their ideas in both digital and material mediums.

---

target users:

- Knowledge workers roughly within the age group of 20 - 50
- People who evolve intangible information into physical forms
- Designers, students, artists, educators...
- People who deal with both digital and physical forms of their work
- People who use both software and hardware to evolve and share their ideas
- People who integrate/combine/merge both digital and physical forms of content

questions:

- How do you transform an intangible idea into a physical form?
- What kind of personalized process(es) do you use to evolve and execute your ideas?
- Do you utilize digital or physical tools in your process? If so, How?(independently or in combination)
- What are some of your methods for organizing your thoughts and ideas?
- What kinds of specialized tools do you use to access, view, and manipulate critical information in your design process?
- Where do you do most of your work when evolving an idea for a design concept? (in a sketchbook, on a computer, drafting desk, model shop, etc.)
- How do you translate your ideas from the virtual medium of the computer into a physical, tangible representation?
- How do you transfer information from the physical world into the digital realm?
- Do you tend to work in a localized environment or is your work more mobile in nature?
- Is there a general environment or setting which is more conducive for your work?
- What are the essential features of a workspace that supports your creative work?
- If you could improve the interface between your physical-tangible work and your digital-intangible work, what might you add, omit, or attempt to further develop?

*If you have an interest in submitting your feedback, please include your comments on the back of this form.
(for more information, visit www.zen0.cc/gradthesis)

Physical-Virtual Workspaces

Connecting Tangible and Intangible Information Experience

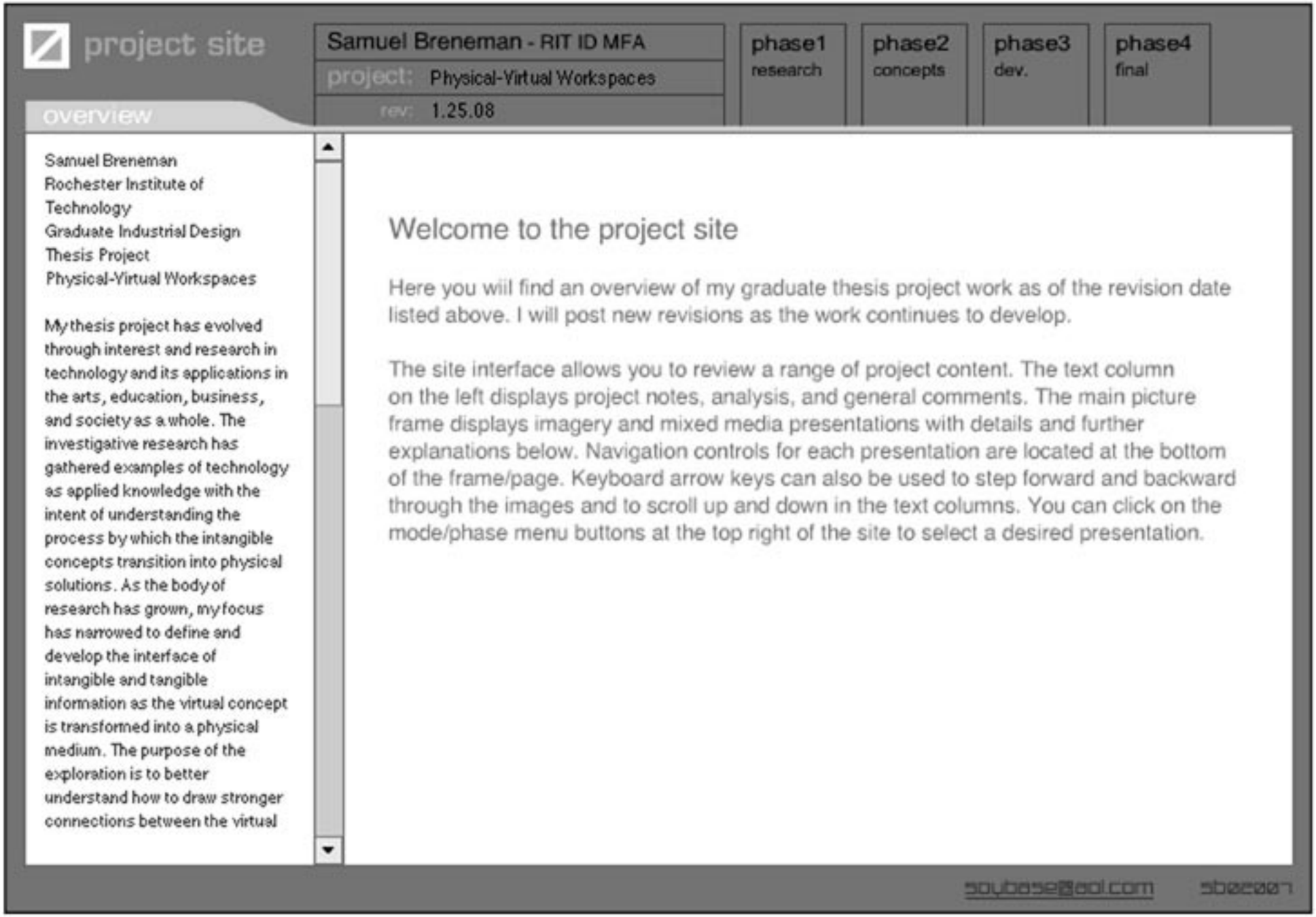
questions:

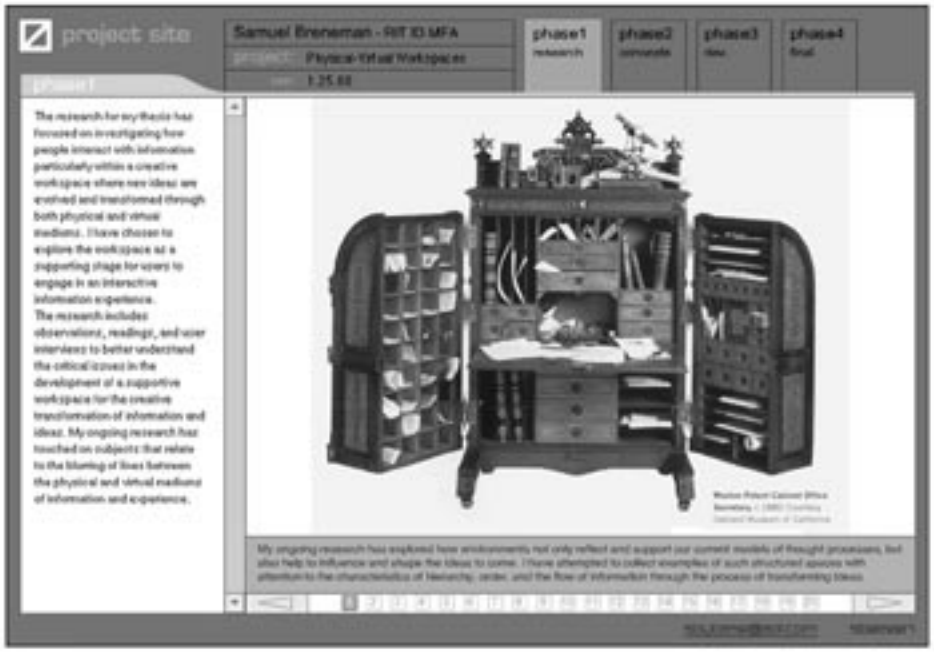
- How do you transform an intangible idea into a physical form?
- What kind of personalized process(es) do you use to evolve and execute your ideas?
- Do you utilize digital or physical tools in your process? If so, How?(independently or in combination)
- What are some of your methods for organizing your thoughts and ideas?
- What kinds of specialized tools do you use to access, view, and manipulate critical information in your design process?
- Where do you do most of your work when evolving an idea for a design concept? (in a sketchbook, on a computer, drafting desk, model shop, etc.)
- How do you translate your ideas from the virtual medium of the computer into a physical, tangible representation?
- How do you transfer information from the physical world into the digital realm?
- Do you tend to work in a localized environment or is your work more mobile in nature?
- Is there a general environment or setting which is more conducive for your work?
- What are the essential features of a workspace that supports your creative work?
- If you could improve the interface between your physical-tangible work and your digital-intangible work, what might you add, omit, or attempt to further develop?

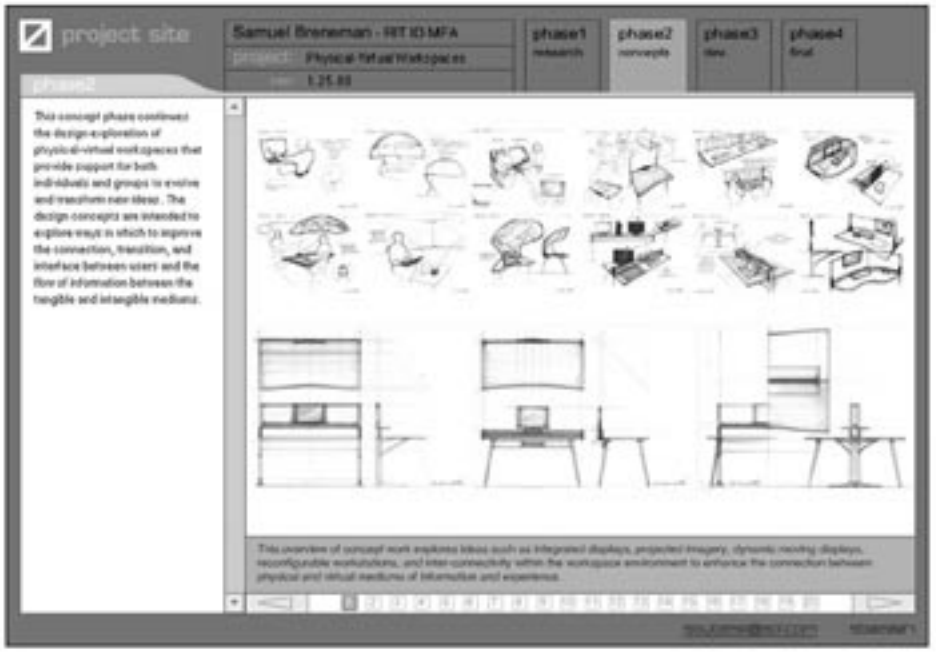
---

name: _____
male/female: _____
age: _____
occupation/title: _____
type of work: _____

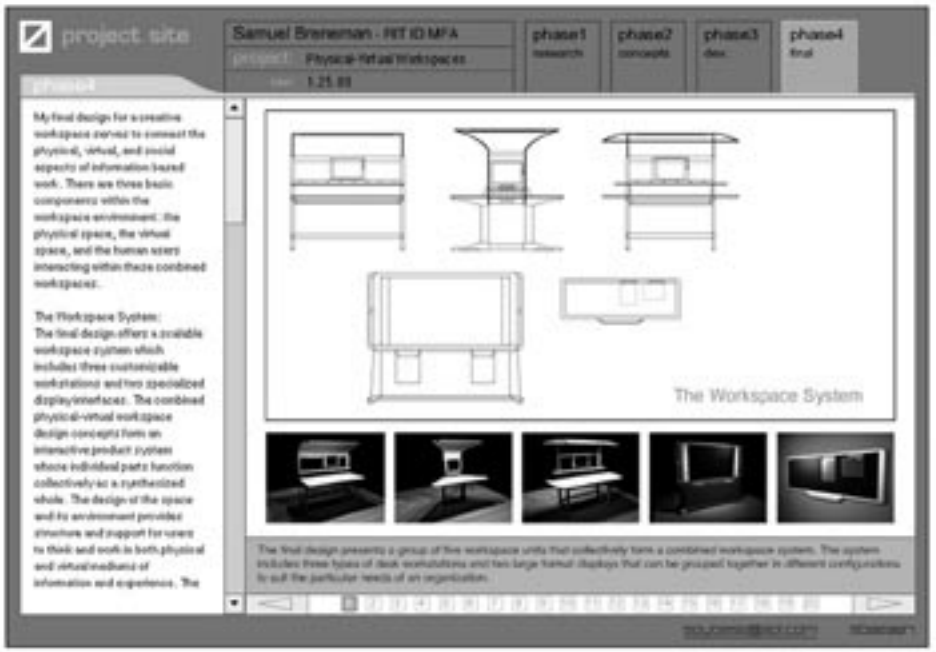
Samuel Breneman RIT - GRAD ID Graduate Thesis Physical-Virtual Workspace 12.12.06


project site
Samuel Breneman - RIT ID MFA
project: Physical-Virtual Workspaces
rev: 1.25.08
phase1 research
phase2 concepts
phase3 dev.
phase4 final
overview
Samuel Breneman
Rochester Institute of Technology
Graduate Industrial Design
Thesis Project
Physical-Virtual Workspaces
My thesis project has evolved through interest and research in technology and its applications in the arts, education, business, and society as a whole. The investigative research has gathered examples of technology as applied knowledge with the intent of understanding the process by which the intangible concepts transition into physical solutions. As the body of research has grown, my focus has narrowed to define and develop the interface of intangible and tangible information as the virtual concept is transformed into a physical medium. The purpose of the exploration is to better understand how to draw stronger connections between the virtual
Welcome to the project site
Here you will find an overview of my graduate thesis project work as of the revision date listed above. I will post new revisions as the work continues to develop.
The site interface allows you to review a range of project content. The text column on the left displays project notes, analysis, and general comments. The main picture frame displays imagery and mixed media presentations with details and further explanations below. Navigation controls for each presentation are located at the bottom of the frame/page. Keyboard arrow keys can also be used to step forward and backward through the images and to scroll up and down in the text columns. You can click on the mode/phase menu buttons at the top right of the site to select a desired presentation.


project site
Samuel Breneman - RIT ID MFA
project: Physical-Virtual Workspaces
phase1 research
phase2 concepts
phase3 dev
phase4 final
The research for my thesis has focused on investigating how people interact with information particularly within a creative workspace where new ideas are evolved and transformed through both physical and virtual mediums. I have chosen to explore the workspace as a supporting stage for users to engage in an interactive information experience.
The research includes observations, readings, and user interviews to better understand the critical issues in the development of a supportive workspace for the creative transformation of information and ideas. My ongoing research has touched on subjects that relate to the blurring of lines between the physical and virtual mediums of information and experience.
My ongoing research has explored how environments not only reflect and support our current models of thought processes, but also help to influence and shape the ideas to come. I have attempted to collect examples of such structured spaces with attention to the characteristics of hierarchy, order, and the flow of information through the process of transforming ideas.


project site
Samuel Breneman - RIT ID MFA
project: Physical-Virtual Workspaces
phase1 research
phase2 concepts
phase3 dev
phase4 final
This concept phase continues the design exploration of physical-virtual workspaces that provide support for both individuals and groups to evolve and transform new ideas. The design concepts are intended to explore ways in which to improve the connection, transition, and interface between users and the flow of information between the tangible and intangible mediums.
This overview of concept work explores ideas such as integrated displays, projected imagery, dynamic moving displays, reconfigurable workstations, and inter-connectivity within the workspace environment to enhance the connection between physical and virtual mediums of information and experience.

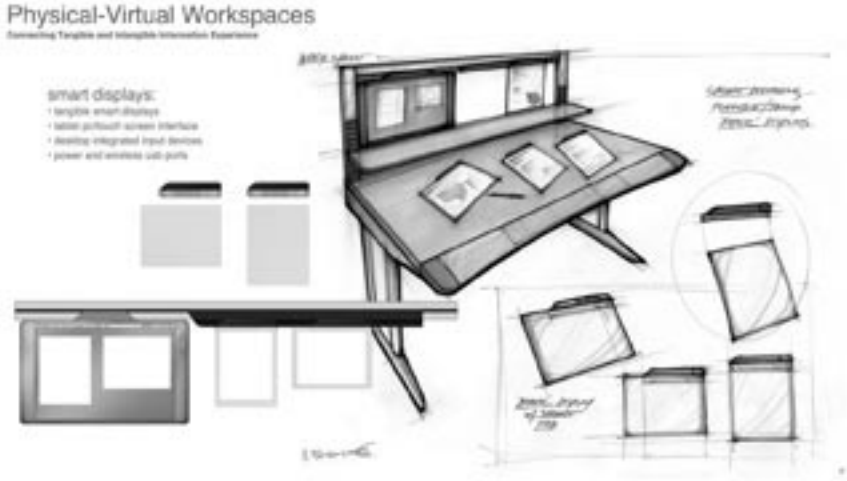

project site
Samuel Breneman - RIT ID MFA
project: Physical-Virtual Workspaces
phase1 research
phase2 concepts
phase3 dev
phase4 final
The development phase has been focused on exploring the creative workspace as a setting for the transformation of information through tangible and intangible mediums. Within this creative stage, the initial virtual-intangible idea is evolved through the design process into a physical-tangible representation. My focus in connecting aspects of the virtual and physical mediums of this process is intended to improve and add deeper meaning to the user's information experience.
Physical-Virtual Workspaces
Notes:

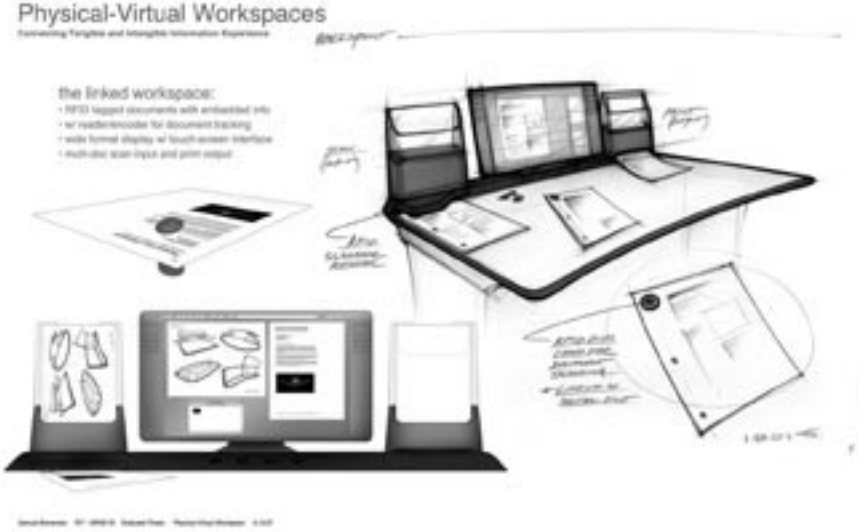

project site
Samuel Breneman - RIT ID MFA
project: Physical-Virtual Workspaces
phase1 research
phase2 concepts
phase3 dev
phase4 final
My final design for a creative workspace serves to connect the physical, virtual, and social aspects of information based work. There are three basic components within the workspace environment: the physical space, the virtual space, and the human users interacting within these combined workspaces.
The Workspace System:
The final design offers a scalable workspace system which includes three customizable workstations and two specialized display/interfaces. The combined physical-virtual workspace design concepts form an interactive product system whose individual parts function collectively as a synthesized whole. The design of the space and its environment provides structure and support for users to think and work in both physical and virtual mediums of information and experience. The
The Workspace System
The final design presents a group of five workspace units that collectively form a combined workspace system. The system includes three types of desk workstations and two large format displays that can be grouped together in different configurations to suit the particular needs of an organization.

Physical-Virtual Workspace

the modular workspace

The concept for a physical-virtual workspace interprets the traditional desk as a platform... a framework... a stage for the development of new ideas. The design of the space provides structure and support for users to think and work in both physical and virtual mediums of 'thought space'. This workspace concept serves as an immediate environment for users to explore and compose new ideas. The modular design of each workstation unit incorporates power and data port connections for various digital interfaces, a pin-up board, privacy screen, and overhead lighting for a unified space.





Physical-Virtual Workspace

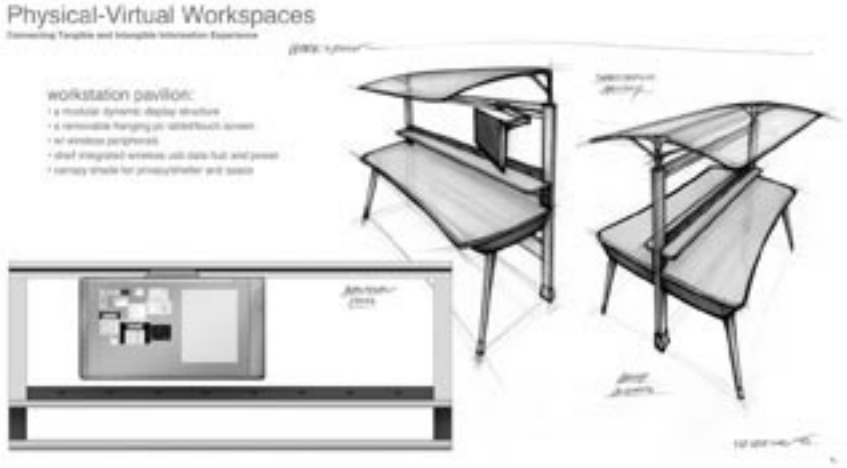
the lightweight workstation

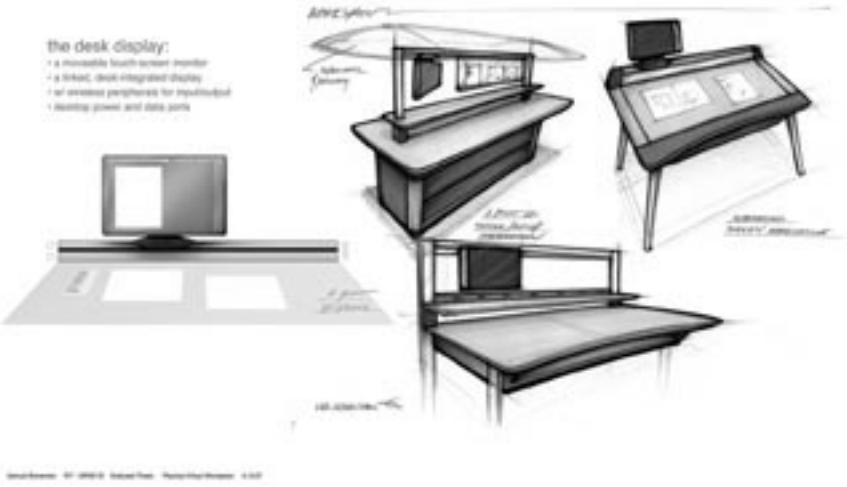
This concept for a lightweight workstation offers users a convenient and easy to configure workspace capable of serving as either an individual docking station or as a group of clustered units. Each workstation unit incorporates power and data port connections for various digital interfaces, a privacy screen, and overhead lighting. The angled edges of the worksurface allow for the units to be arranged in multiple orientations allowing users to creatively structure the patterns and divisions of their workspace environment.

Physical-Virtual Workspace

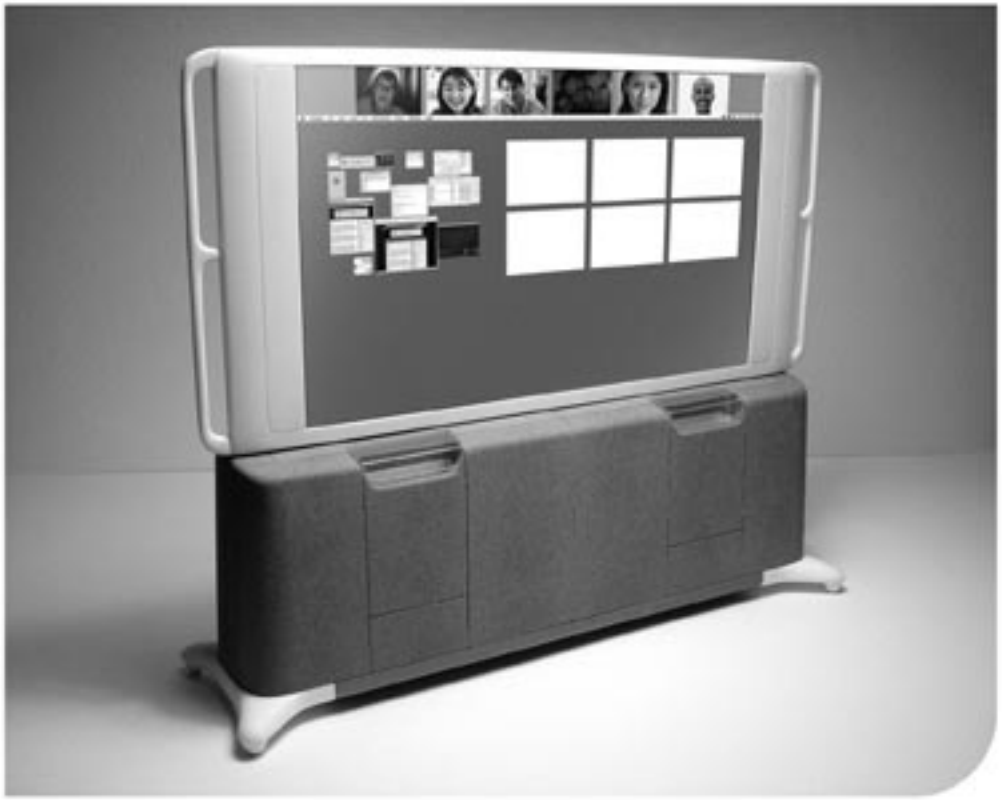
the island pavilion

This workstation concept can be used as a single, open workspace, or with two units joined in an island configuration. The overhanging ends of the worksurface as well as the display shelf offer a flexible space for group collaboration and the presentation of information and new ideas. Each workstation unit incorporates power and data port connections for various digital interfaces, a privacy screen-canopy, and optional lighting to create a unified workspace environment.



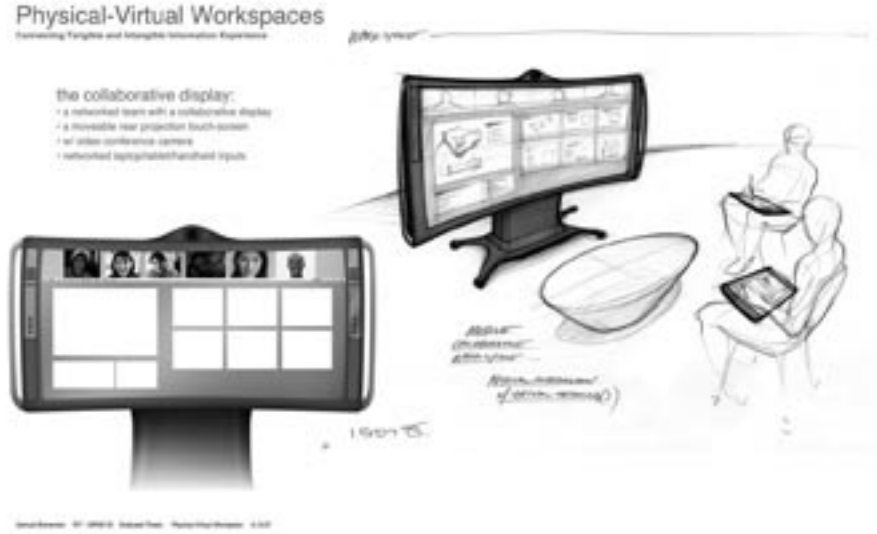


Physical-Virtual Workspace

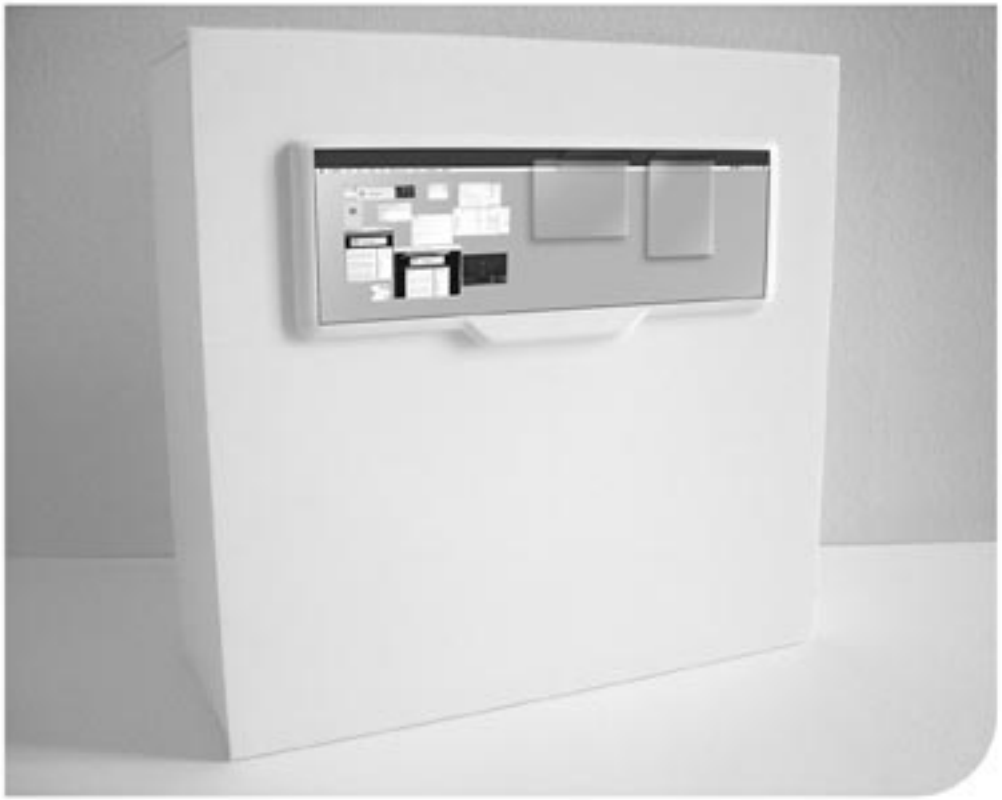


the collaborative display

The collaborative display serves users with a group workspace to display, explore, and communicate their ideas through an open and intuitive interface. The large touchscreen display can provide users with an overview of their collective project work while also functioning as a networked communications interface. The mobile display includes data ports as well as a multi-document scanner and printer allowing users to effectively translate information between both tangible and intangible mediums. Individual workstations and mobile PC's could be networked to the display enabling users to track, organize, and display their combined work.

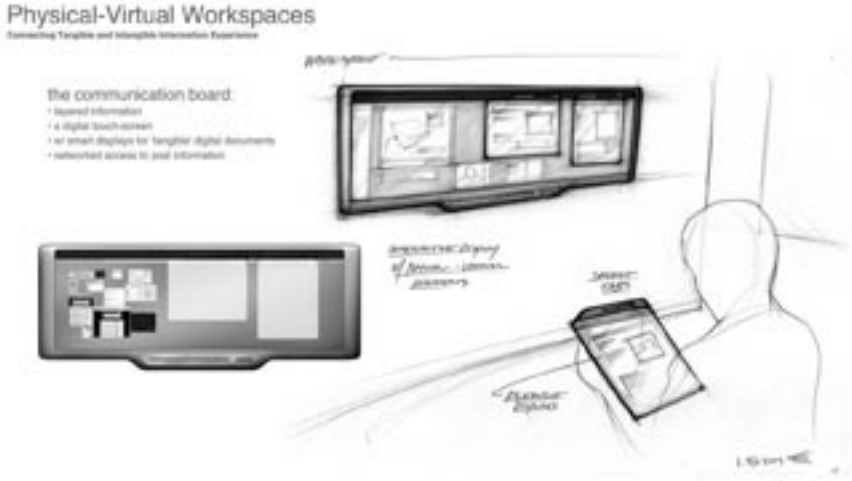


Physical-Virtual Workspace

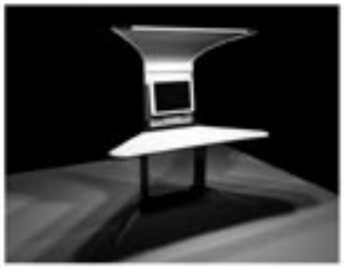


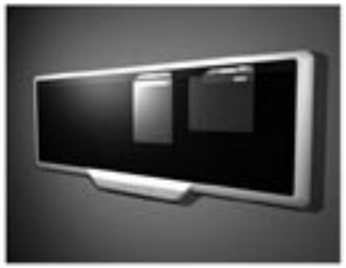
the networked display board

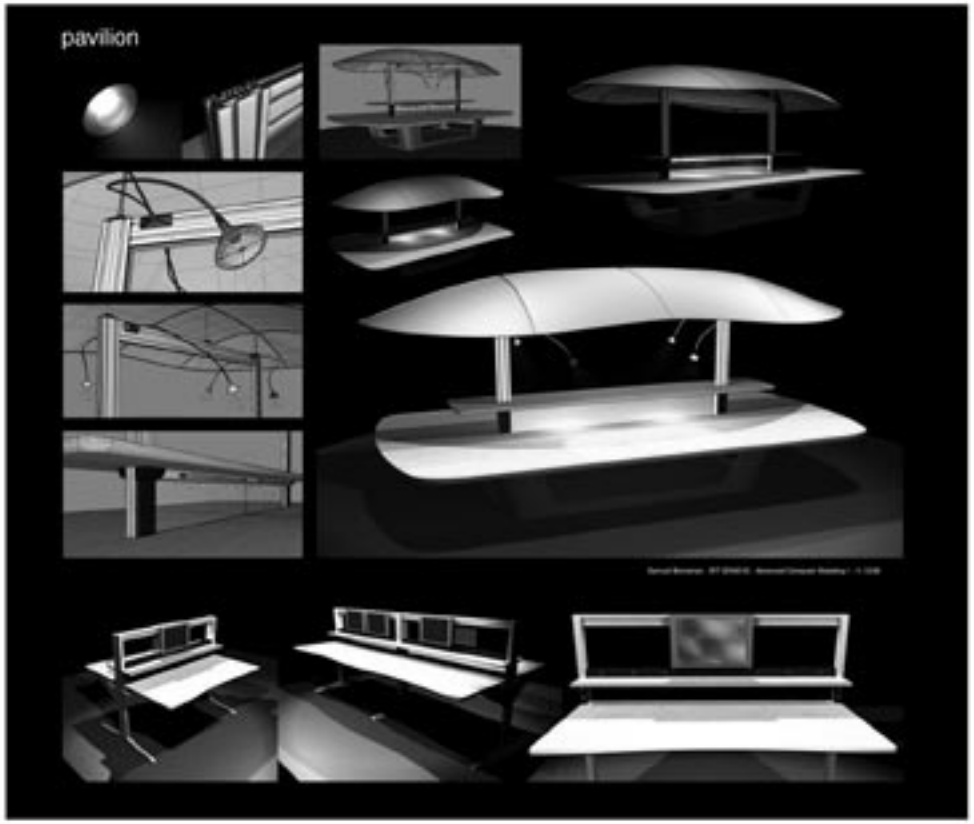
This concept for a networked display serves as a dynamic information and communications interface. Users and groups can both view, post, and edit information either directly through the touchscreen interface, or from a separate networked location. Additional data ports also allow users to upload or download content directly from the display unit. Secondary 'smart documents' serve as detachable handheld displays for viewing, sharing, and editing dynamic content.



Physical-Virtual Workspace



the workspace system

The combined physical-virtual workspace design concepts provide structure and support for users to think and work in both physical and virtual mediums of information and experience. The concepts merge elements of the tangible space with various interfaces to intangible virtual space and the digital medium.

Physical-Virtual Workspaces

Final Design

Concept 1

the modular workspace

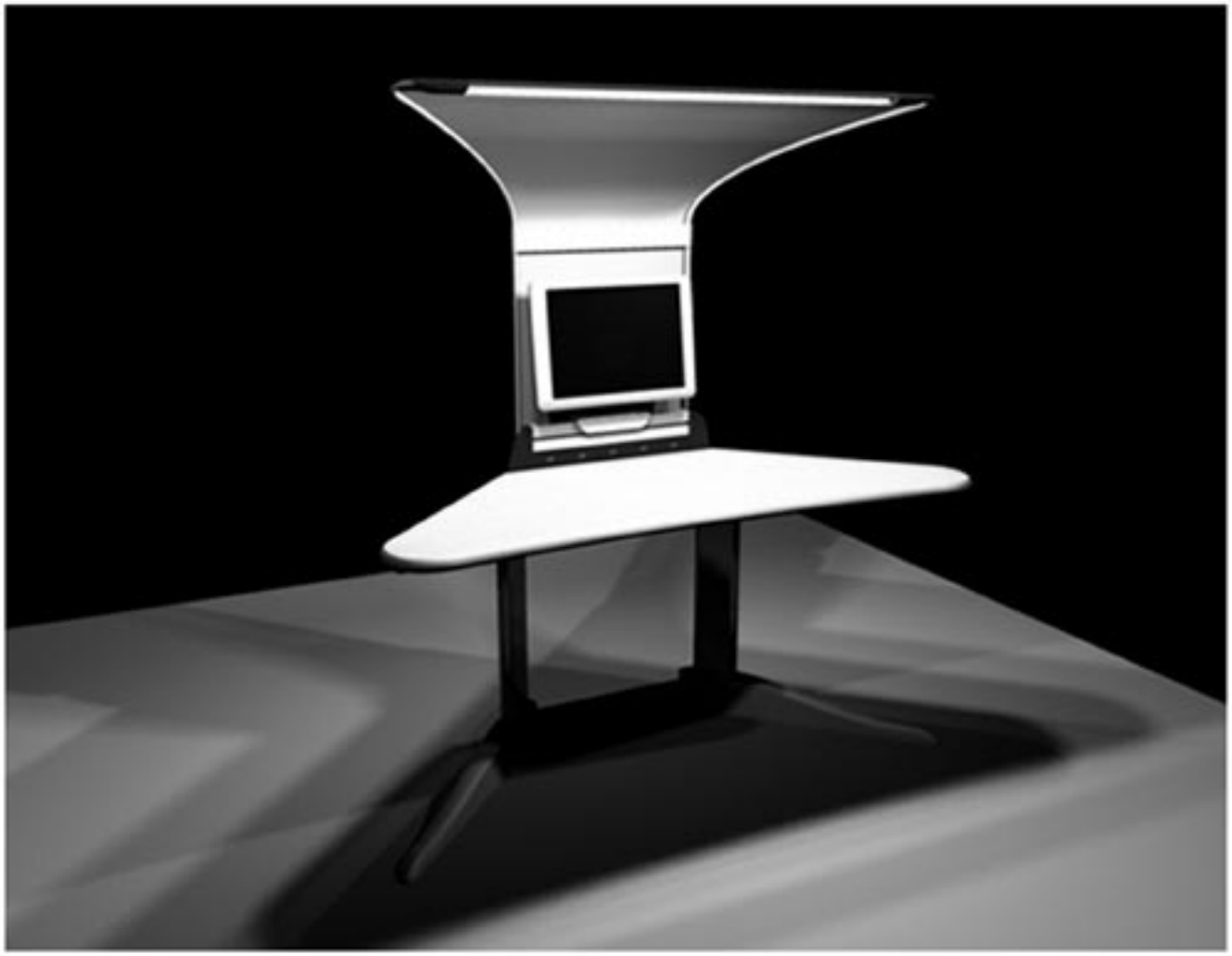
- *contoured worksurface*
- *modular aluminum extrusion frame*
- *tablet pc/touch-screen interface*
- *sliding/adjustable display mount*
- *access to AC power outlets*
- *shelf with wireless USB hub*
- *options for removable back panels*
- *privacy screen/canopy*
- *integrated overhead lighting*

Final Design

Concept 2

the lightweight workstation

- *contoured worksurface*
- *modular aluminum extrusion frame*
- *tablet pc/touch-screen interface*
- *sliding/adjustable display mount*
- *access to AC power outlets*
- *integrated wireless USB hub*
- *privacy screen/panels/canopy*
- *integrated overhead lighting*



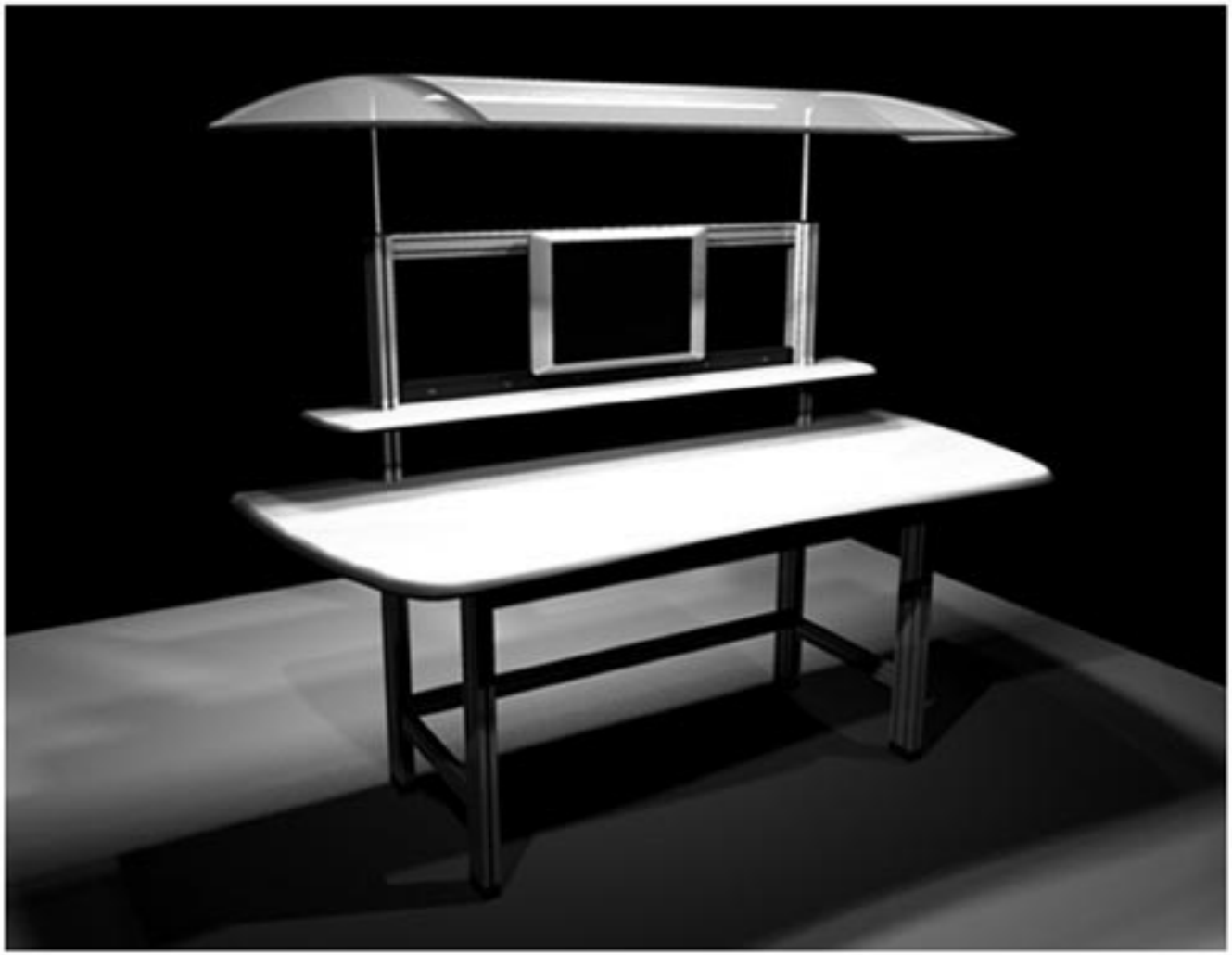
Physical-Virtual Workspaces

Final Design

Concept 3

the island pavilion

- *contoured worksurface*
- *modular aluminum extrusion frame*
- *tablet pc/touch-screen interface*
- *sliding/adjustable display mount*
- *access to AC power outlets*
- *shelf with wireless USB hub*
- *options for removable back panels*
- *privacy screen/canopy*
- *integrated overhead lighting*

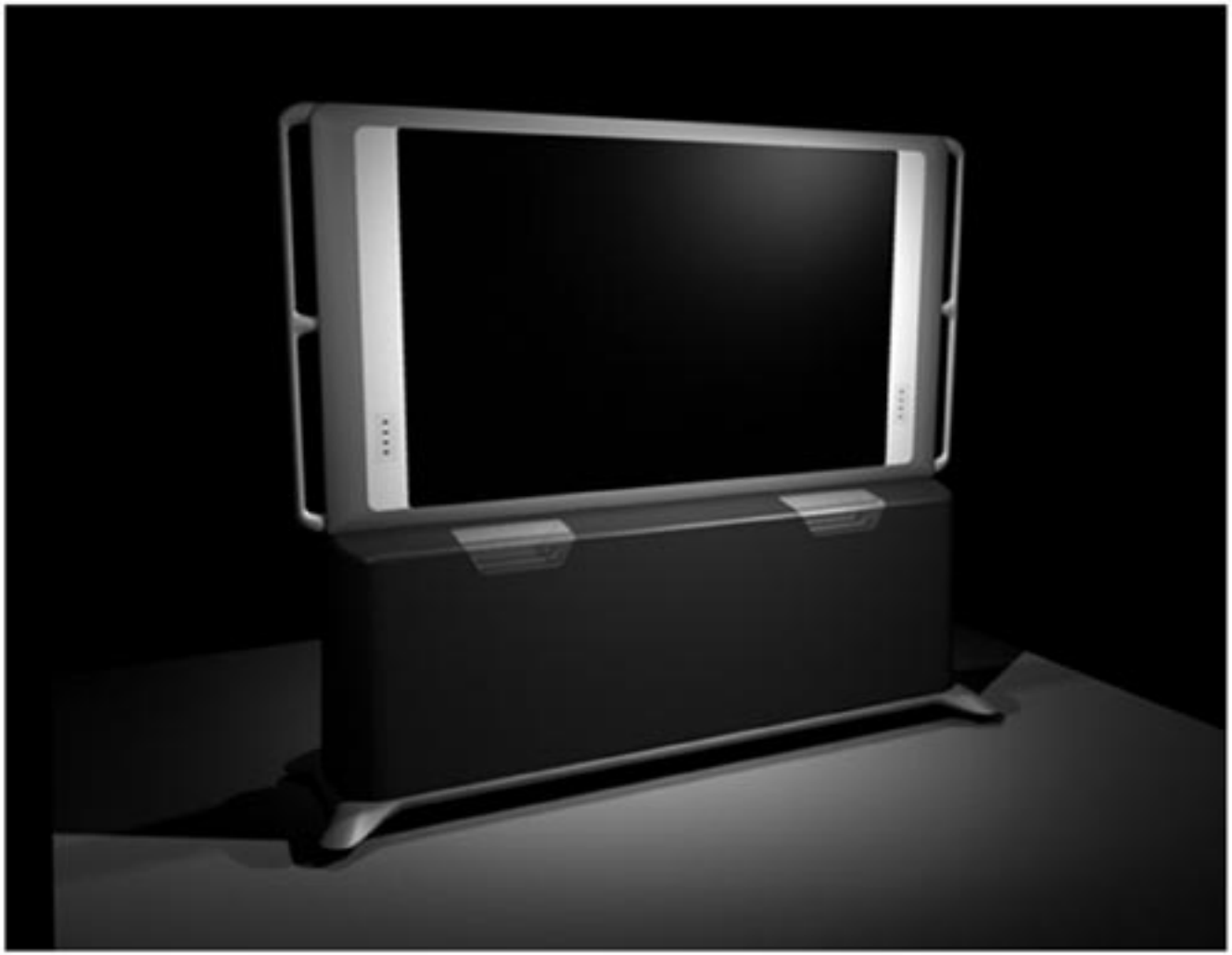


Final Design

Concept 4

the collaborative display

- *integrated pc/touch-screen interface*
- *mobile stand w/ optional storage*
- *multi-document scanner and printer*
- *frontside USB data ports*



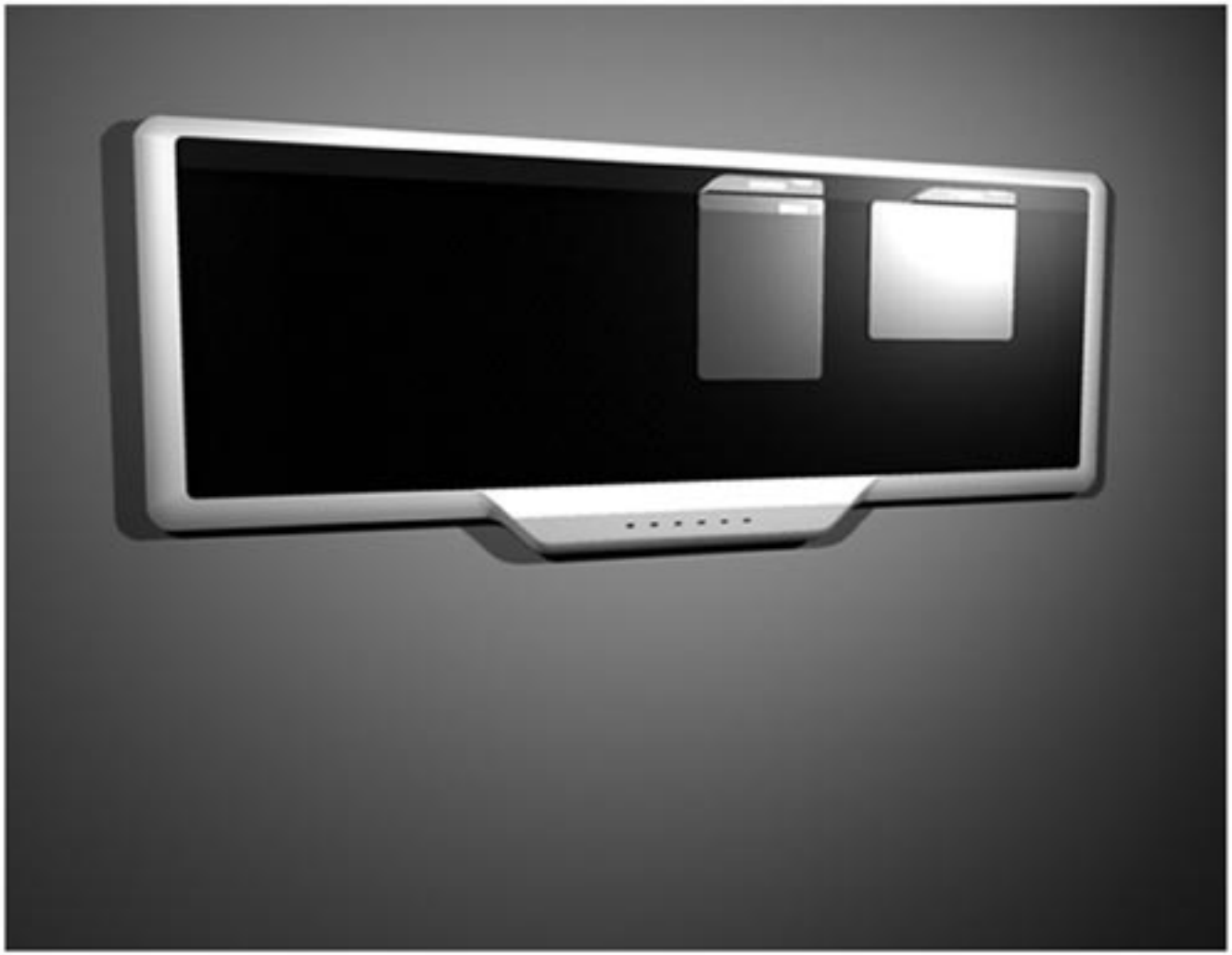
Physical-Virtual Workspaces

Final Design

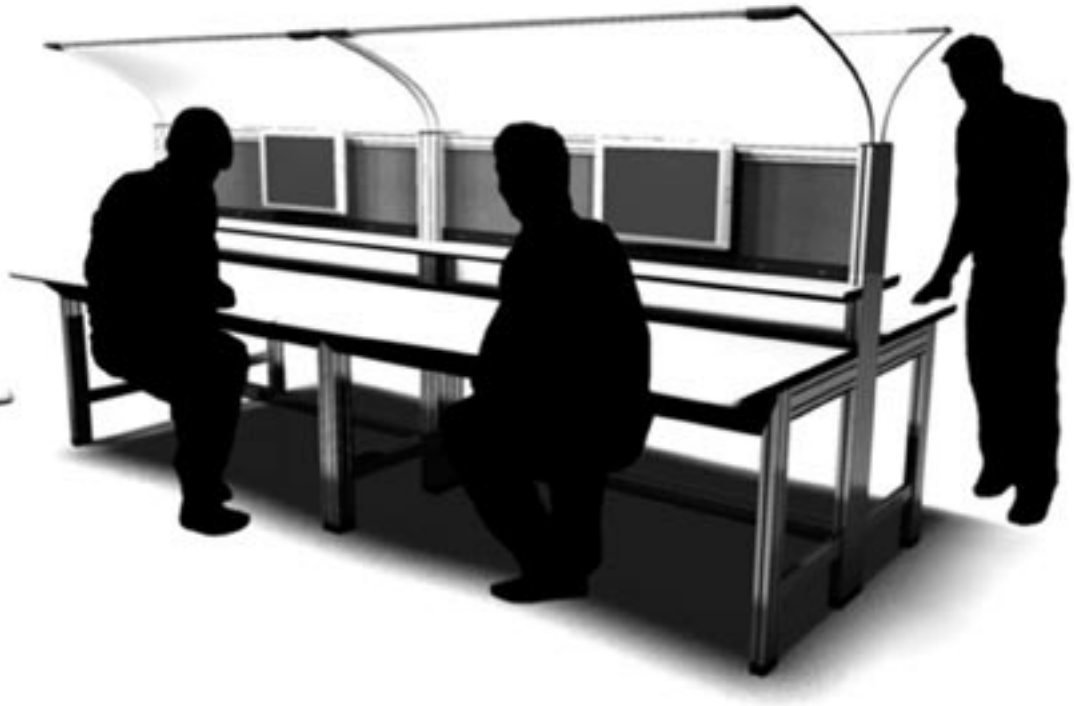
Concept 5

the networked display board

- *integrated pc/touch-screen interface*
- *interactive detachable 'smart-displays'*
- *frontside USB data ports*

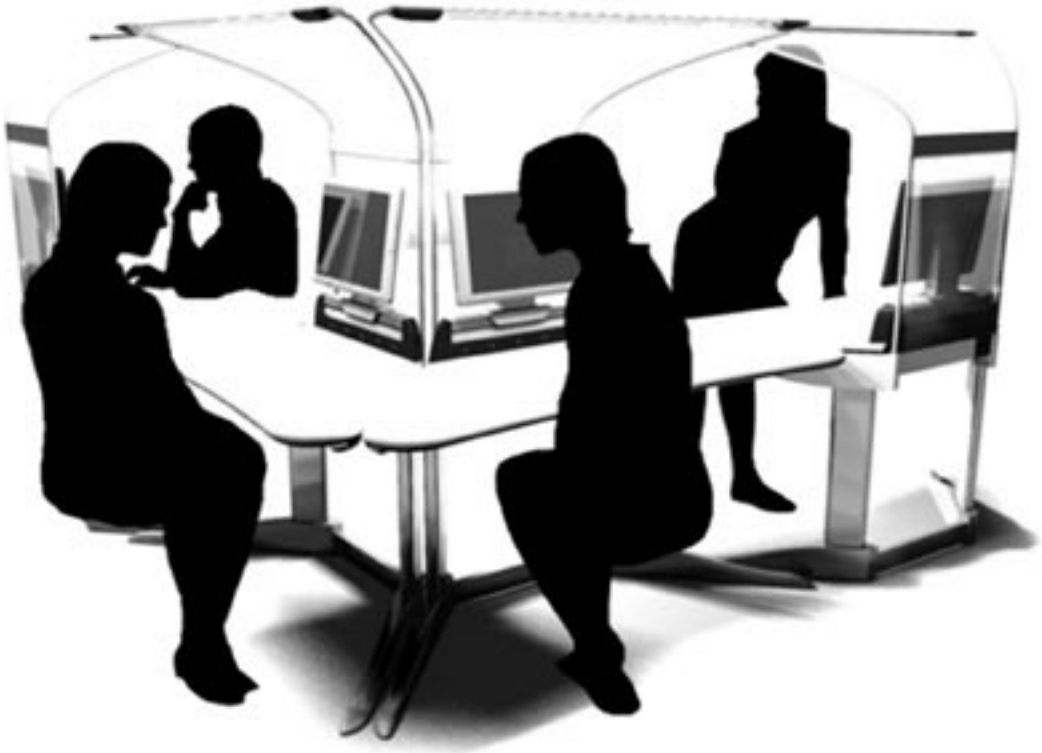


Final Design

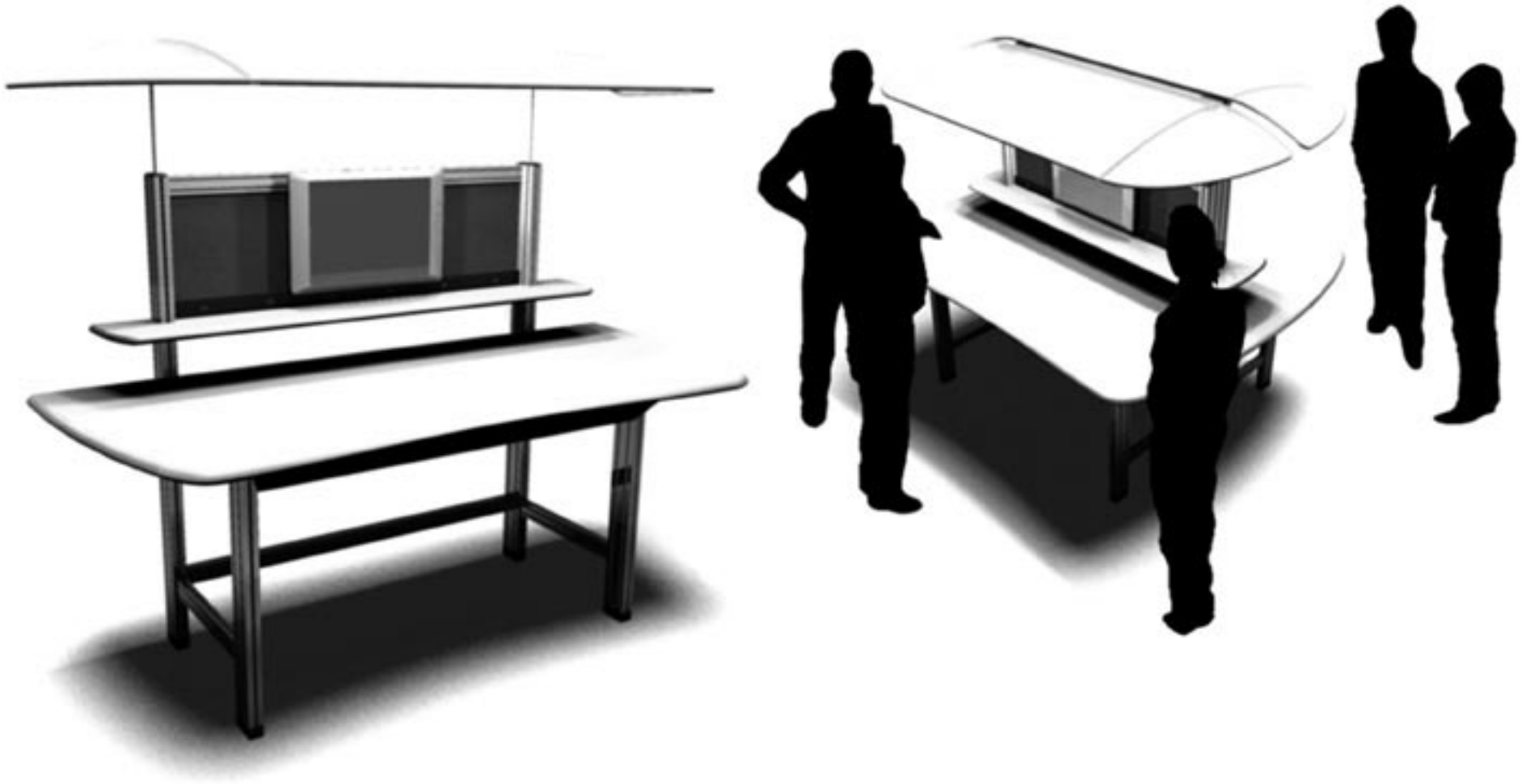


Physical-Virtual Workspaces

Final Design



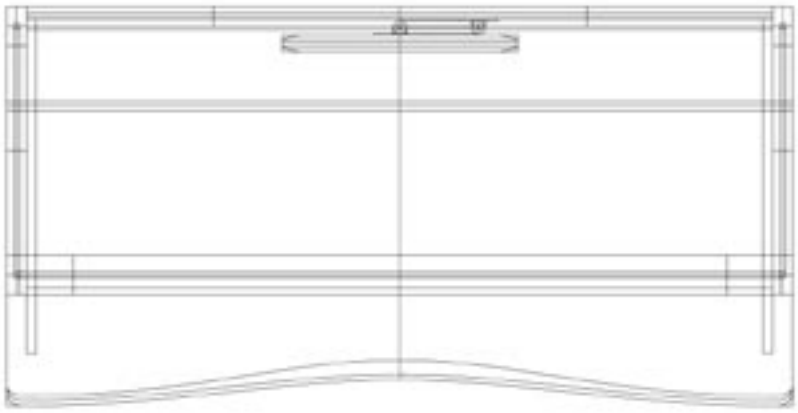
Final Design

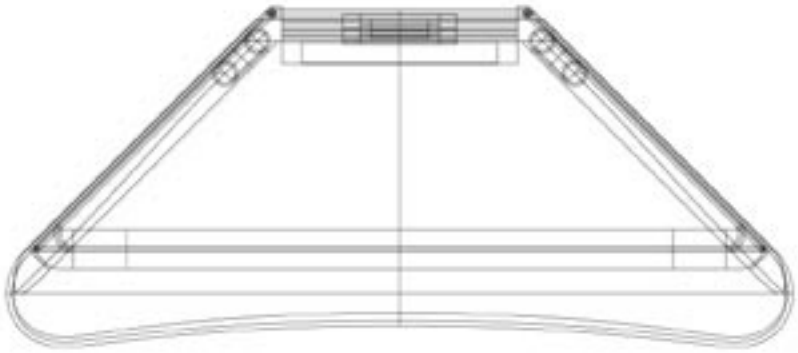


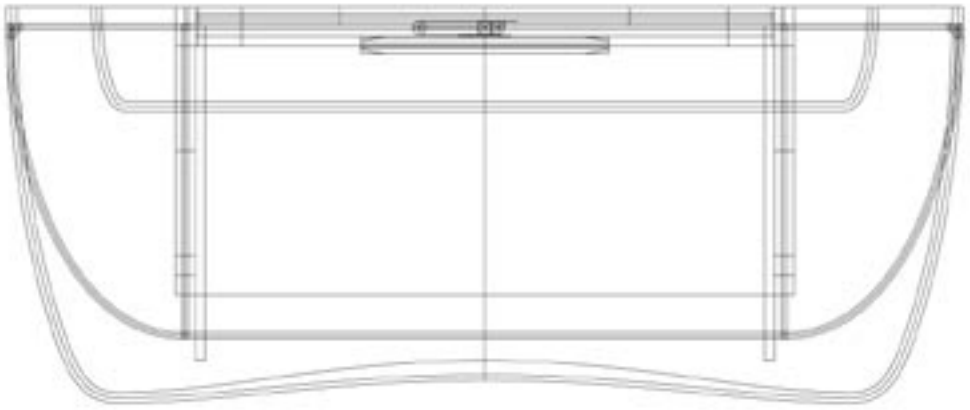
Physical-Virtual Workspaces

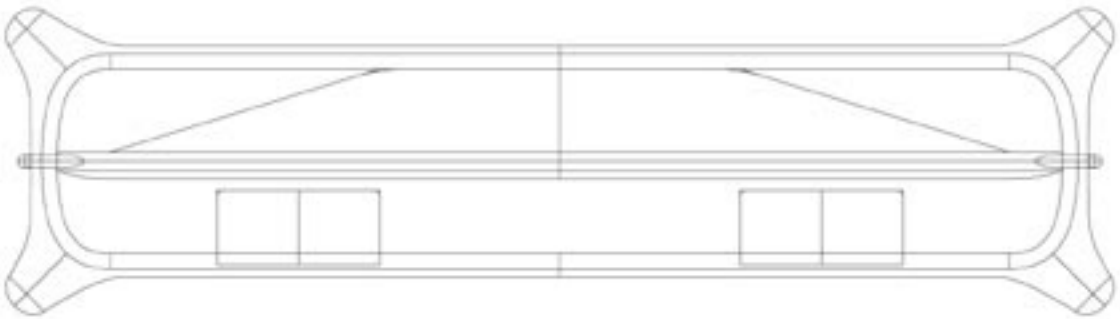
Final Design

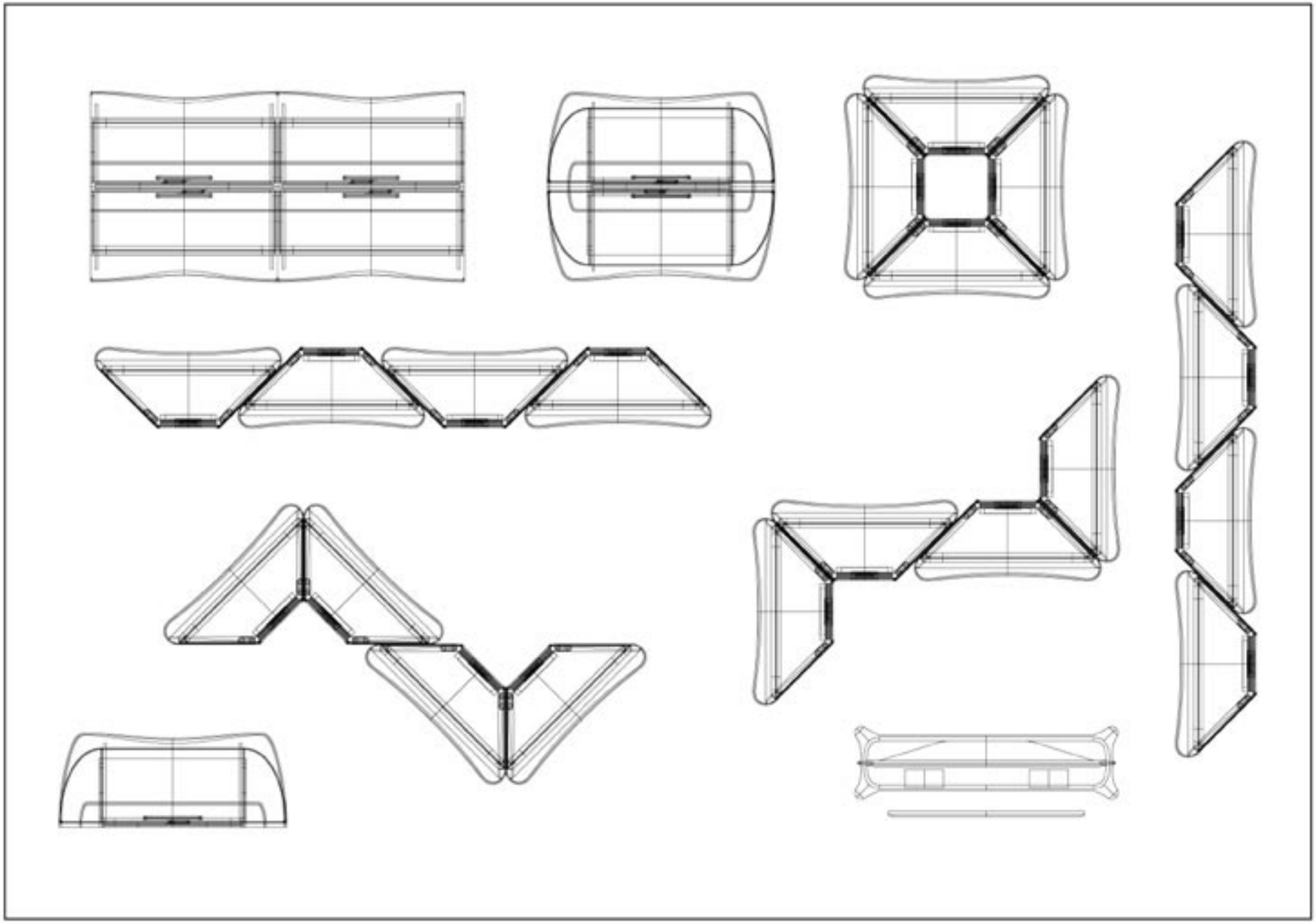
Final Design

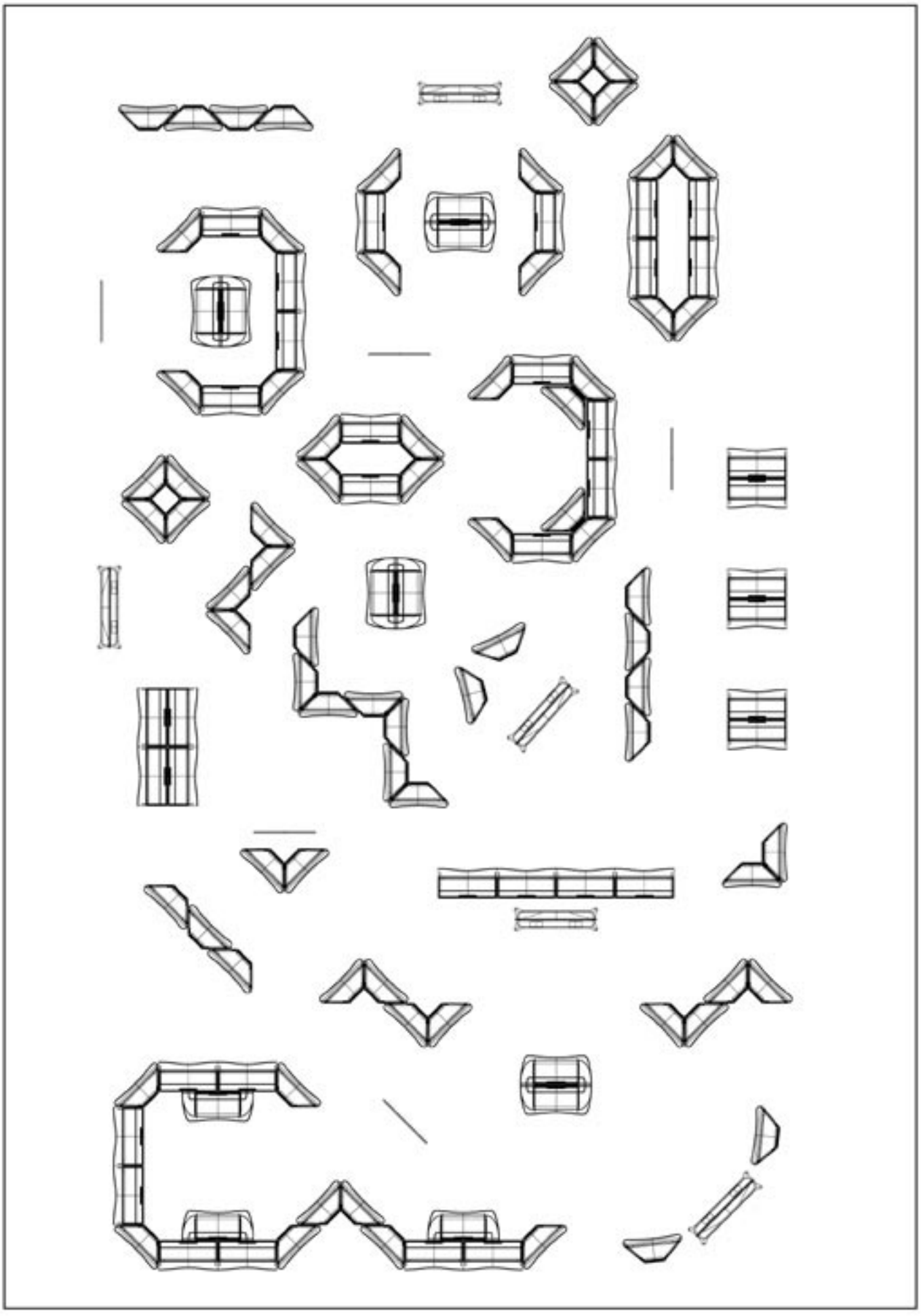








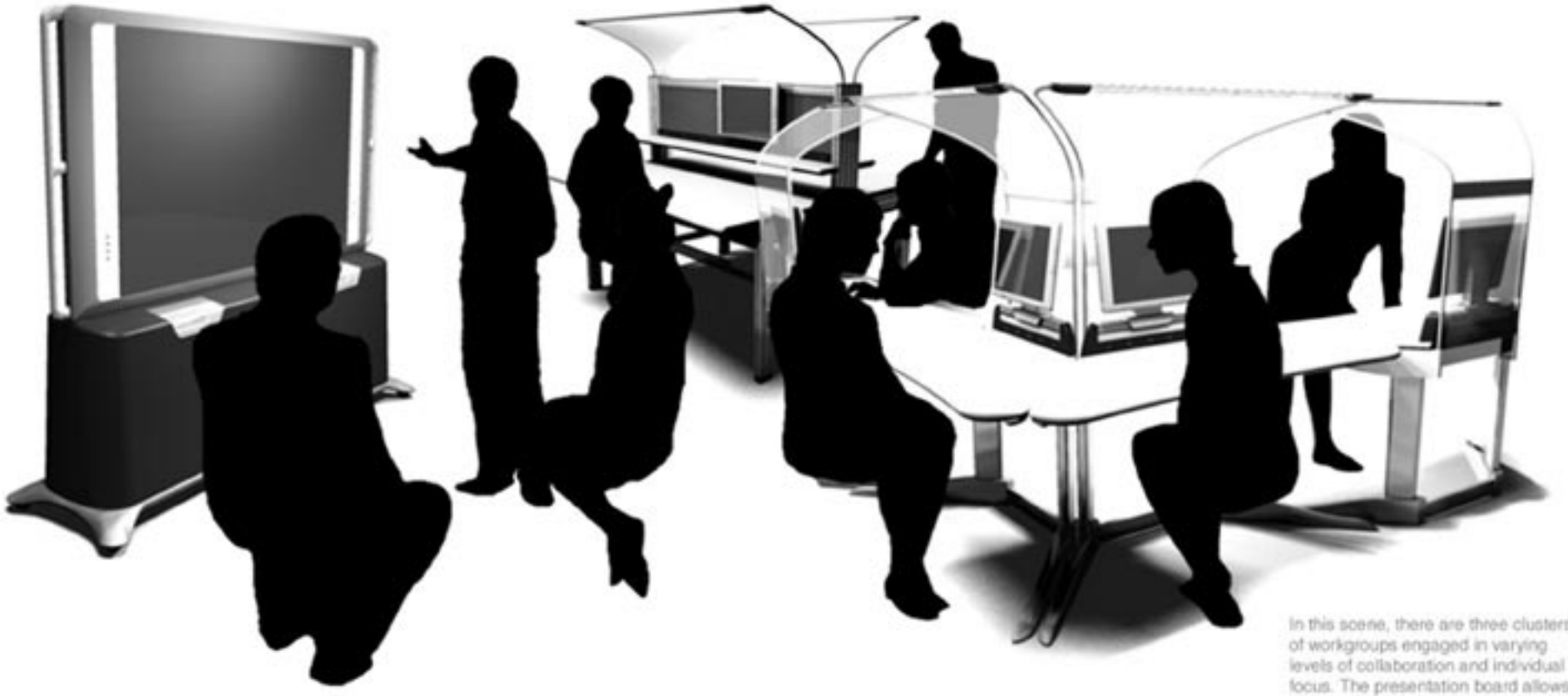




Conclusion

Design for human interaction...

In the same way that these multiple workspace solutions act together to offer more diverse capabilities and opportunities, the collective efforts and interactions of human users are similar in that they can exponentially increase the power of our creative intelligence. The final design seeks to reflect these strengths and benefits of an interrelated system of combined elements whose synthesized whole is greater than the sum of its individual parts.



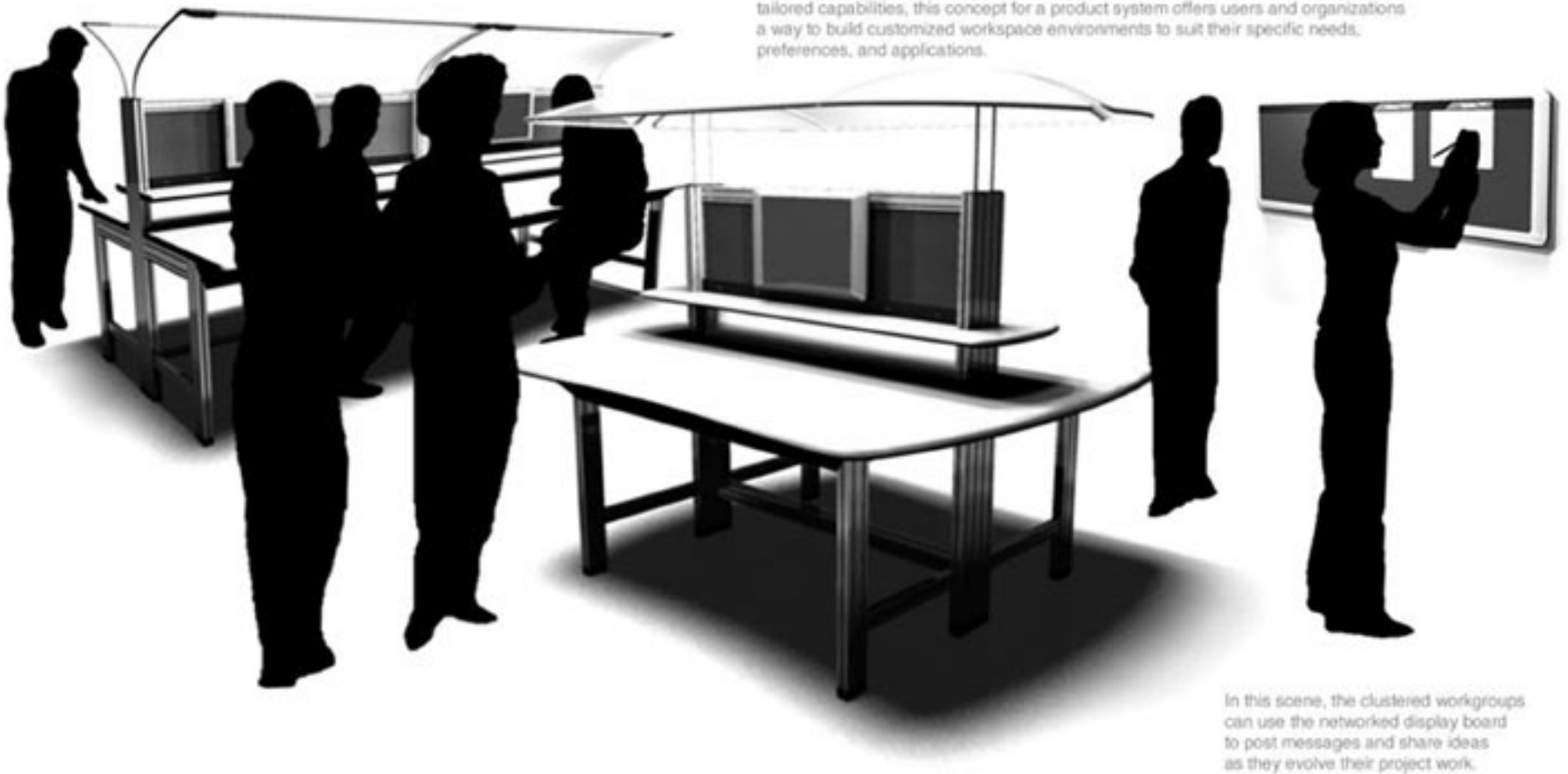
In this scene, there are three clusters of workgroups engaged in varying levels of collaboration and individual focus. The presentation board allows them to view their collective work.

Physical-Virtual Workspaces

Conclusion

Design for human interaction...

Together these workspace concepts serve to create more meaningful relationships between the work and the users. As tools for connecting the tangible and intangible forms on information based work, these concepts collectively function as a specialized system for processing information as well as providing a system to support human user interaction and collaborative thinking. By providing a range of workstations with tailored capabilities, this concept for a product system offers users and organizations a way to build customized workspace environments to suit their specific needs, preferences, and applications.



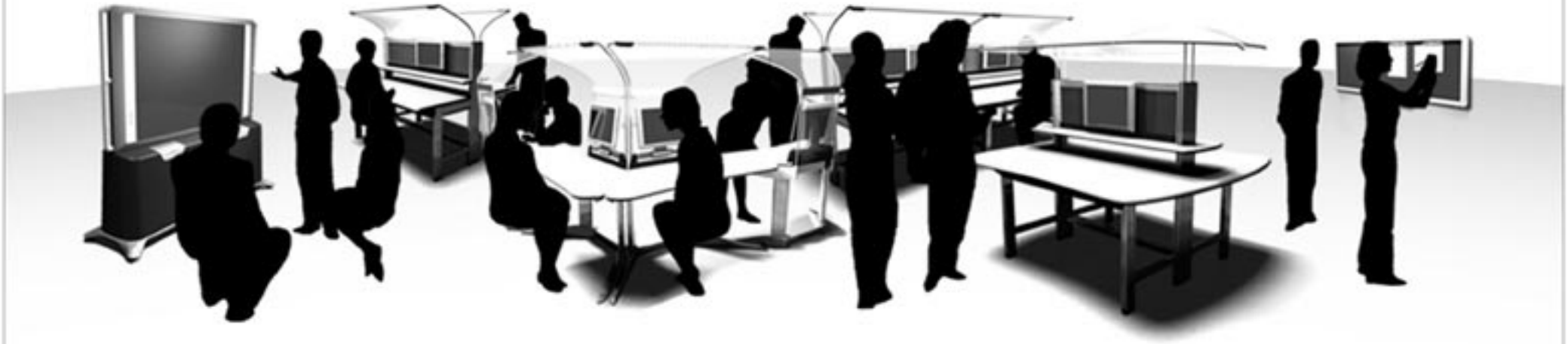
In this scene, the clustered workgroups can use the networked display board to post messages and share ideas as they evolve their project work.

Conclusion

Design for human interaction...

In essence, the creative workspace serves to develop the human interactions involved in the creative exploration and development of new ideas. By helping users to connect the meaning of their ideas in both the tangible and intangible mediums, the physical-virtual workspace acts to knit together the different mediums of information and user experience. As humans interact within the workspace environment, they share their thoughts and ideas, but they also share an interactive experience as well. In this way, the building of knowledge develops as a result of both shared ideas and shared experiences.

In the end, the workspace itself becomes secondary to the knowledge generated through shared human interaction and experience.



Special Thanks to...

My Thesis Committee Members:

David Morgan - RIT Industrial Design - Graduate Coordinator, Assistant Professor
-
Alan Reddig - RIT Industrial Design - Lecturer
-
Adam Smith - RIT New Media - Assistant Professor

Contributing Advisors:

Khipra Nichols - RISD industrial design
Bob O'Neal - RISD industrial design
Fredrick Kuhn - WIT industrial design
Sam Montague - WIT industrial design
Jeffrey Michael - RISD industrial design
Carl Sukeforth - RISD furniture/id
AJ Kassenaar - industrial design
Bill Seaman - RISD digital media
Stan Rickel - RIT industrial design

Special thanks to my family, friends, and peers who offered much assistance, encouragement and advice throughout the course of this thesis project.

Bibliography

Research Bibliography and References

Albrecht, Donald and Chrysanthe B. Broikos. 2000. *On The Job, Design and The American Office*. New York, NY: Princeton Architectural Press.

Antonelli, Paola. 2001. *Workspheres, Design and Contemporary Workstyles*. The Museum of Modern Art, New York. New York,NY: Harry N. Abrams, Inc.

Barnatt, Christopher. 1999. *Valueware - Technology, Humanity and Organization*. Westport, CT: Praeger Publishers.

Becker, D. Franklin. 1981. *Workspace, Creating Environments in Organizations.* New York, NY: Praeger Publishers.

Dunne, Anthony and Fiona Raby. 2001. *Design Noir: The Secret Life of Electronic Objects*. August/Birkhauser.

Gehry, Owen Frank. 2003. *Flowing in All Directions*. Los Angeles, CA: CIRCA Publishing.

Gelb, J. Michael. 1998. *How To Think Like Leonardo DaVinci, Seven Steps to Genius Everyday*. New York, NY: Delacorte Press.

Green, David. 2004. *The Serendipity Machine*. Australia: Allen and Unwin.

Kelly, Tom w/ Jonathan Littman. 2001. *The Art of Innovation, Lessons in Creativity from IDEO*. New York, NY: Double Day, Random House.

Levy, Pierre. 1997. *Collective Intelligence - Mankind's Emerging World in Cyberspace*. New York, NY: Plenum Trade Press, Inc.

Mitchell, J. William. 1995. *City of Bits, Space, Place, and The Infobahn*. Cambridge, MA: MIT Press.

Negroponte, Nicholas. 1995. *Being Digital*. New York, NY: Alfred A. Knopf, Inc.

Postman, Neil. 1992. *Technopoly - The Surrender of Culture to Technology*. New York: Alfred A. Knopf, Inc.

Seaman, Ph.D. Bill. 2003. **Interflow Architectures*.

Steele, I. Fred. 1973. *Physical Settings and Organization Development*. Addison-Wesley Publishing Company, Inc.

Wikipedia. Peter Ferdinand Drucker.
http://en.wikiquote.org/wiki/Peter_Drucker (accessed 7.19.07).
http://en.wikipedia.org/wiki/Knowledge_worker (accessed 7.19.07).

References

pictures, illustrations, graphic references

Design Documentation: