Kinda Human

Enhancing Expression and Understandsing in an Intimate Relationship Through Artificial Agents

Scott Dombkowski

IRB: ID: STUDY2018_00000427
IRB: ID: STUDY2018_00000561

These studies were approved by the Institutional Review Board at Carnegie Mellon University

Kinda Human

Enhancing Expression and Understanding in an Intimate Relationship Through Artificial Agents

Scott Dombkowski, Author

Stacie Rohrbach, Advisor

Molly Wright Steenson, Advisor

A thesis submitted to the School of Design, Carnegie Mellon University,
for the degree of Master of Design in Design for Interactions

Acknowledgements

To my Mother, Father, Suzanne, Grandma, Bobby, Aunt Alice, and Aunt Conch. Your love has made me the person I am. I owe this all to you. You will always inspire everything I do.

To Molly and Stacie. Thank you for the support and guidance you have provided me for the past year and a half.

Lastly to my friends, classmates, the Morrison Cycle Circle, the Snooze Saloon, and Luzerne Avenue. Thank you for sharing the last three years with me.

Abstract

Today, many designers concern themselves with efficiency, effectiveness, and productivity when considering relationships between humans and artificial agents. While these three dimensions are essential to consider, they fail to embrace our humanity (i.e., our ability for self-expression and for understanding others) and present an opportunity for designers to consider dimensions present in our relationships that make us human. This thesis project explores two of those dimensions—expression and understanding—in the context of intimate relationships.

In this thesis, I:

- Investigated the theory, potential applications, and affordances of intimate relationships (which tend to be a person's most defining and determining), artificial agents, and other relevant research areas.
- Acquired a comprehensive understanding of the models users have of artificial agents and intimate relationships by conducting several design studies.
- Created and evaluated several artificial agents designed to enhance intimate partners' capacity for expression and understanding.
- Developed a set of principles and challenges to assist those designing for expression and understanding in intimate relationships.

Ultimately, this thesis serves as a lodestar that is intended to guide designers through the inherent complexities of designing interfaces that leverage artificial agents to aid expression and understanding by the user. I aim for my research and exploration to apply to areas that extend beyond a focus on expression and understanding, and serve as a guide for anyone who is interested in learning how designers might address dimensions that cannot be easily measured.

Contents

Introduction

At the core of intimate relationships are conversations—exchanges of thoughts and words that often focus on intimacy, expectations, communication, and the past. These conversations result in feelings of loyalty, honesty, mutual understanding, and intimacy. All of these feelings have been principally ignored when designing artificial agents. Instead, designers often concern themselves with efficiency, effectiveness, and productivity. While these three dimensions are essential to consider, they fail to embrace our humanity—specifically, our ability for self-expression and for understanding others, the emotional and intellectual mechanisms we employ, the vast differences in our makeup and experiences, our propensity to make the same errors more than once, and our idiosyncrasies.

I believe that the current focus on efficiency, effectiveness, and productivity reveals an opportunity for designers to consider dimensions present in our relationships that make us human. As artificial agents become more pervasive and closely connected to our everyday lives, dimensions present in human-to-human relationships that cannot be easily measured demand attention. This thesis explores how designers can facilitate relationships between humans and artificial agents to strengthen people's emotional connections with each other.

Research Question

Over the course of my thesis, I was guided by the following design question; “How might artificial agents be designed to enhance intimate partners’ capacity for expression and understanding in their relationship?”.

Scope

This thesis focuses on intimate relationships and how an artificial agent might constructively affect those relationships. I selected intimate relationships as a context for study because they are often our most defining and determining relationships. They constitute experiences with which almost all humans can relate, and they provide a space for play and reflection. Intimate relationships are also comprised of qualitative dimensions that make us human, such as expression and understanding, that designers typically do not consider when working with artificial agents. Instead, they often address more measurable dimensions like efficiency, effectiveness, and productivity. With the ever-increasing influence of artificial agents, I believe there is a need, now more than ever, to interrogate how an agent can positively affect an intimate relationship.

I acknowledge that this focus on the integration of agents into interfaces could prevent me from designing interfaces that positively affect an intimate relationship more than a conversation with a therapist or other analog activities ever could. At the same time, it has helped me define a relevant area of study (i.e., as the artificial becomes more and more closely connected to our everyday lives, it is bound to involve itself in our intimate relationships in ways we cannot predict today).

Potential For Impact

As I began this project, I hypothesized that romantic relationships would provide a rich area to explore the relationship between humans and artificial agents, particularly because of the different forms of communication (e.g., verbal, non- verbal) employed, the high stakes at play, and the increased possibility for emotion to take the place of logic. Now at the close of the study, I believe that this thesis did not only explore that relationship but provides insight into how an artificial agent can:

- Enhance an intimate partners' capacity for expression and understanding
- Help a partner better understand themselves, their partner, and their relationship
- Support a diversity of intimate relationships (i.e., intimate relationships can come in all shapes and sizes)

While also bringing to light:

- The possibilities for artificial agents to successfully integrate into an intimate relationship
- How design research can be applied to aid the understanding of the relationship between humans and artificial agents
- Conversational symbiosis and how an experience can support it
- How interfaces that integrate artificial agents can support conversational symbiosis while effectively integrating into an individual's life
- How interfaces can support fluid exchanges between humans and artificial agents
- How artificial agents can be well integrated into interfaces

By designing artificial agents, I was also able to explore ways of broadening an individual's perspective of relationships between humans and artificial agents through an expansion of approachable concepts. I recognize the need to create images that depict possibilities of relationships between humans and artificial agents that extend beyond those solely dealing with efficiency, effectiveness, and productivity. The artificial agents leverage images that use language accessible to a general audience. This approach strives to make concepts approachable, increase their appeal to people's imagination, and evolve their understanding of artificial agents.

Throughout this research project, I found that when I described my project, I would inadvertently remind individuals of movies that portrayed agents in a negative light (e.g., *Her*, *Ex Machina*) or apps that promoted sophomoric representations of intimate relationships (e.g., Tinder). These references clarify the need for positive and more nuanced depictions of agents, which is something I continuously aimed to create.

At the same time, I believe that parts of this study can apply to contexts that extend beyond intimate relationships, such as relationships between family members, co-workers, and teachers and students. Dimensions at play between an intimate couple, including expression and understanding, are also often at play among the people in those relationships.

Assumptions

This thesis assumes a reader has familiarity with the concept of an intimate relationship and has interacted with a range of artificial agents.

If a reader does not have an understanding of the emotions and experiences that typically comprise an intimate experience, they will likely struggle in recognizing the value of this study. If they have not interacted with a range of artificial agents, they will likely be unable to identify how the interfaces I have designed address dimensions not typically considered when designing interfaces that leverage artificial agents.

Terminology

This section outlines the terminology used throughout this paper.

Artificial Agent

An artificial agent is a computationally-based artifact viewed as perceiving its environment and taking action based on that information. Examples include Alexa and Google Search.

Conversational Interface

An interface that provides "a means or place of interaction" (Interface, 2019) for the exchange of "thoughts and words" (Conversation, 2019) between two or more systems (e.g., person, piece of technology). Examples of conversational interfaces are Slack and a Google Home.

Conversational Symbiosis

Conversational symbiosis is an intimate cooperation that embraces differences, takes advantage of competencies, and promotes a mutual understanding to augment the intellect of two or more dissimilar things in ways they can not achieve themselves.

Experience

An experience is anything that can be viewed as "an event by which one is effected" (Experience, 2019).

Frame

A frame is "an organizational principle or coherent set of statements that are useful to think with" (Dorst, 2015, p. 63). For instance, an individual that sees fear as an opportunity is operating from a different frame than an individual that sees fear as an obstacle.

Interface

An interface is "a form of relation that obtains between two or more distinct entities, conditions, or states such that it only comes into being as these distinct entities enter into an active relation with one another" (Hookway, 2014, p. 4). Examples include both analog and digital artifacts such as web browsers, smart watches, and letters.

Intimate Relationship

An intimate relationship is a relationship comprised of "knowledge, caring, interdependence, mutuality, trust, and commitment" (Miller, 2012, p. 2).

Model

A model is a "way of thinking" (von Glasersfeld, 1995, p. 146) that forms and creates relationships between concepts. Models individuals have include their expectations for intimate partners and their understanding of time (i.e., time as a commodity).

Limitations

The research studies and prototypes emerging from this thesis have limitations, which are listed below.

Lack of Funding

The entirety of the project was self-funded. For this reason, my ability to recruit research participants from outside the campus community and experiment with different technologies was limited.

The Capabilities of Today's Technology

Both the research studies and prototypes in this study are inspired by contemporary technology, but follow a discursive approach and at times take liberty in regards to what technology is capable of doing today (i.e., most of my prototypes rely on NLP technology that is not possible today) for me to test concepts and the assumptions behind those concepts.

Difficulty in Accessing a Representative Collection of Research Participants

University students and Mechanical Turk workers comprised my pool of research participants throughout the year. While I attempted to gather representative participant groups, my participant pool does not accurately reflect a random sample of intimate partners. For that reason, results from this study can not be generalized as representative of intimate couples.

Digital Platforms

I used a variety of platforms in this project, including:

The Affectiva SDK

The Affectiva SDK is an API that enables developers "to detect emotion in real time on a device to analyze your recorded media" (SDK, n.d.) and was used in a concept that detected the emotions an individual conveyed at the dinner table.

After Effects

After Effects is a "motion graphics and visual effects software" (Adobe After Effects, n.d.) that was used to create a variety of concept videos throughout this project.

Dialogflow

Dialogflow is Google's tool to "build natural and rich conversational experiences" (Dialogflow, n.d.). I used Dialogflow in the backend of a conversation simulator and a Google Home action for couples to uncover and develop visions for their future together.

Mechanical Turk

Mechanical Turk is "a crowdsourcing marketplace" (Amazon Mechanical Turk, n.d.) that I used to affordably test concepts with an audience I would not be able to access otherwise.

Twilio Programmable SMS

Programmable SMS enables a developer to "send and receive text messages" (SMS, n.d.). I used this API for prototyping a scenario (i.e., the sending back and forth of messages) a user could have on a conceptual messaging app.

Overview of Study

My process was comprised of four phases: discovery, definition, exploratory, and generative. I designed each phase with the intent of deriving insights that could then inform work in future phases.

Discovery Phase

The discovery phase centered around building a base of knowledge that could inspire and inform this thesis.

Definition Phase

The definition phase focused on investigating the theory, potential applications, and affordances of relevant research areas by conducting literature reviews, artifact reviews, and conversations with experts.

Exploratory Phase

The exploratory phase focused on studies designed to acquire a more comprehensive understanding of the models users have of artificial agents and intimate relationships. Emphasis was placed on developing insights based on first-hand experiences with an artificial agent and in an intimate relationship. These studies led me to design a set of 'How Might I...' statements that deeply informed concepts in the generative phase.

Generative Phase

The generative phase was dedicated to creating and evaluating artificial agents designed to enhance an intimate partners' capacity for expression and understanding. Each artificial agent was designed to take a unique approach on how an agent could enhance intimate partners' capacity for expression and understanding.

Discovery Phase

I initially became interested in this area when I wrote "A Consideration of Today's Conversational Interfaces Courtesy of Cybernetics and Yesterday's Conversational Interfaces," a paper in which I employed cybernetic frameworks and historical conversational interfaces to examine why conversational interfaces were "failing in their most basic form, conversation" (Dubberly & Pangaro, 2009) and propose potential approaches to address those shortcomings.

This paper served as my introduction to Hugh Dubberly and Paul Pangaro's work on conversation and several precursory conversational interfaces including Gordon Pask's Musicolour and Terry Winograd's The Coordinator. Research that ultimately provided me insight into how those interfaces not only laid the groundwork (i.e., development of technology, GUI, etc...) for the recent influx of conversational interfaces available today, but also kickstarted the directional shift from exploratory inquiries to the commercial applications we see in contemporary conversational interfaces. Musicolour and The Coordinator also struck me as examples of what an experience that focused on expression and understanding instead of efficiency, effectiveness, and productivity could be. With this inspiration, I moved into a secondary phase of research as I wanted to learn more about conversation and other relevant areas that could inform designed interfaces to enhance an intimate partners' capacity for expression and understanding.

Definition Phase

The definition phase was dedicated to understanding the theory, potential application, and affordances. I drew insights from literature, projects, and conversations with experts. While I paid particular attention to both conversation and intimate relationships, I consciously decided to look beyond those subjects and into learning theories, theoretical frameworks, and other areas that might provide a more robust understanding of the topic. The following section outlines the findings pulled from the aforementioned inquiry (Additional in-depth reviews are available online at https://medium.com/men-are-from-kepler-438b-women-are-from-kepler). The discoveries I made informed my understanding of an intimate relationship and the nature of a relationship's conversations as a design space.

Literature Review

The literature I reviewed provided me with a foundation for the exploratory and generative phases. While I focused on intimate relationships and conversation, I made a deliberate decision to look for literature not directly related to my core topic, but still focused on concepts and ideas I believed would benefit my thesis, such as Bernice McCarthy's 4MAT system and Elizabeth Shove's Three Elements. The literature I reviewed ranges from texts focused on conversation, intimate relationships, and interfaces, to learning theories and theoretical frameworks. Below is a description of my literature reviews, organized as a set of guiding questions that I investigated.

What is conversation?

I began my review by establishing an understanding of conversation. While this section of the review was derived mainly from my earlier paper, "A Consideration of Today's Conversational Interfaces Courtesy of Cybernetics and Yesterday's Conversational Interfaces," I also put a considerable amount of effort into deepening that study of literature with a specific focus on the work of Hugh Dubberly and Paul Pangaro.

I was particularly interested in Dubberly and Pangaro's description of the "models of interaction"; "at one extreme … simply reactive systems, such as a door that opens when you step on a mat or a search engine that returns results when you submit a query. At the other extreme is conversation. Conversation is a progression of exchanges among participants" (Dubberly & Pangaro, 2009). Today, we see such "progression" (Dubberly & Pangaro, 2009) or "continuous action conceived or presented as onward movement through time" (Progression, 2019), being achieved very rarely when an artificial agent is involved. This lack of "progression" (Dubberly & Pangaro, 2009) can thus be attributed to conversation being a "highly complex type of interaction …, for conversation is the means by which existing knowledge is conveyed and new knowledge is created" (Dubberly & Pangaro, 2009). Such complexity sheds light on why the artificial agents we commonly interact with are unable to augment conversation today (i.e., assist an individual in improving their communication of information).

How can one navigate the complexity the complexity of conversation?

To overcome this complexity, Dubberly, Pangaro, Pask, and others have developed models that serve as a "way of thinking... [that] involves concepts" (von Glasersfeld, 1995, p. 146) and their formation and the creation of relationships between them.

One particular framework, Gordon Pask's (1976) Conversation Theory, presents a "formalism for describing the architecture of interactions or conversations, no matter where they may arise or among what types of entities" (Pangaro, 2002). Dubberly and Pangaro (2009) have also worked to simplify Pask's (1976) theory into six main tasks that comprise the "Process of Conversation" (Dubberly & Pangaro, 2009): the opening of a channel, a commitment to engagement, the construction of meaning, evolution, a convergence on agreement, and an action or transaction (See Figure 1). They have also worked to clarify these steps into five main "requirements for conversation," which include "[the] establish[ment] of [an] environment and mindset", "[the] use of shared language", "[an] engagement in mutually beneficial, peer-to-peer exchange", "[a] confirmation in shared mental models", and "[an] engagement in a transaction - [the] execution of cooperative actions" (Dubberly & Pangaro, 2009). Conversation Theory, Dubberly and Pangaro's "Process of Conversation" (Dubberly & Pangaro, 2009) and "requirements for conversation" (Dubberly & Pangaro, 2009) bring attention to aspects and considerations designers should consider and employ when working with artificial agents. While some of the artificial agents we see today do address a number of these requirements, one would be extremely hard pressed to present an artificial agent that addresses all of them.

Others researchers including Erika Hall, Paul Grice, and W. Ross Ashby have also created related models. Hall has looked at the ways interaction can be "truly conversational" (Hall, 2019, Error Tolerant, para. 3) and described the "elements of a conversation" as being the system or "a set of interconnected elements that influence one another", the interface or "a boundary across which two systems exchange information", and an interaction or "the means by which the systems influence each other" (Hall, 2019, Interactions Require Interfaces, para. 1). Grice has taken a slightly different approach and developed the Gricean Maxims (See Figure 3) which describe the characteristics of productive communication (e.g., quantity, quality, relation, manner; Grice, 1975). At the same time, Ashby has created a visual model differentiating between the "immaterial aspects" and the "physical world" to show that "actions take place in the physical world, while goals do not (See Figure 2). Goals, the province of cybernetics, are the 'immaterial aspects' of interaction" (Dubberly & Pangaro, 2011).

Together, these models have provided me with a "way of thinking" (von Glasersfeld, 1995, p. 146) about the conversations I motivate between intimate partners. This led me to ask, how could these models inform the design of artificial agents so they could negotiate the complexity of conversation?

How could models of conversation inform the design of artificial agents?

In order to answer this question, I studied the evolving landscape of artificial agents and artificial intelligence by looking into early conversational interfaces (i.e., Musicolour and The Coordinator) and how each represents "an intelligent interface" (Kaplan, 2013).

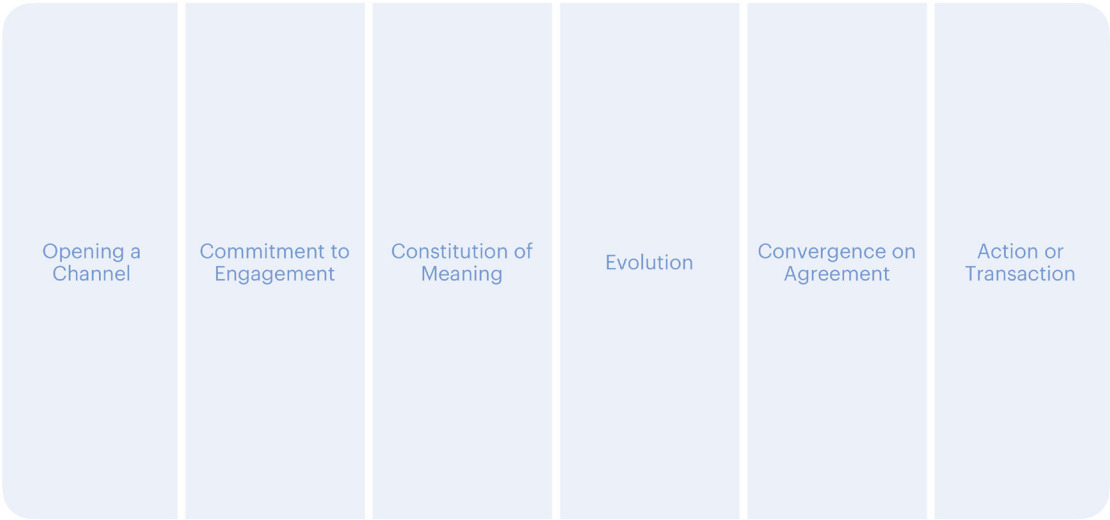


Figure 1
Dubberly and Pangaro, "Process of Conversation"

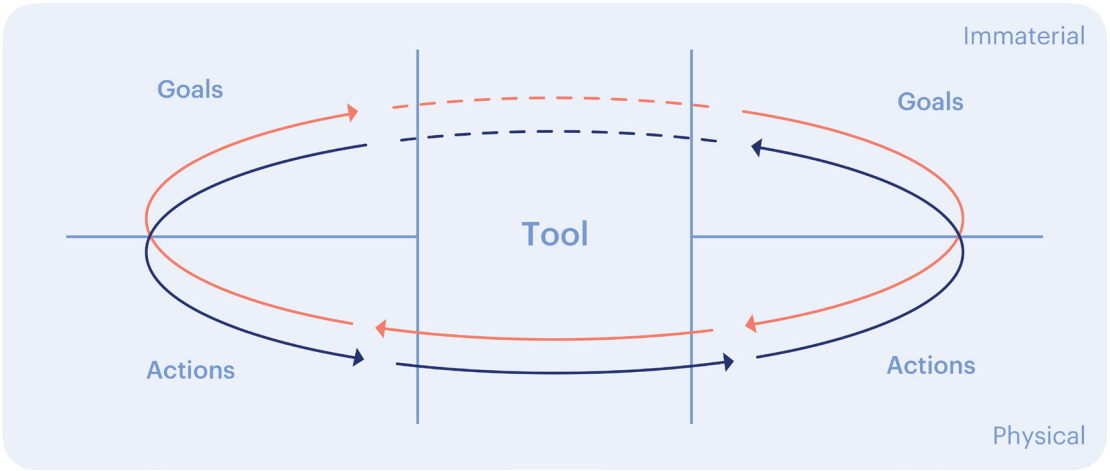


Figure 2
W. Ross Ashby, "Conversation"

Figure 3 *(opposite)*
Grice, "Gricean Maxims"

Maxim of Quantity
Make your contribution as informative as is required.

Maxim of Quality
Do not say what you believe to be false.

Maxim of Relation
Be relevant.

Maxim of Manner
Avoid ambiguity. Be brief. Be orderly.

Musicolour was "a sound-actuated interactive light show" (Bird & Di Paolo, 2008) designed by Gordon Pask (See Figure 4). Pask created a machine in which "the performer 'trained the machine and it played a game with him. In this sense, the system acted as an extension of the world with which he could cooperate to achieve effects... [he] could not achieve on his own.'" (Bird & Di Paolo, 2008) Musicolour reveals that addressing the "requirements for conversation" (Dubberly & Pangaro, 2009) enables a conversation between a human and artificial agent.

The Coordinator is also an example of an experience that enables a conversation between humans and artificial agents (See Figure 5). The system was designed by Terry Winograd to "provide facilities for generating, transmitting, storing, retrieving, and displaying messages that are records of moves in conversations" (Winograd, 1987). Unlike Musicolour, which interpreted the actions of a human, The Coordinator enabled humans to interpret the actions of another while providing the structure for those actions by fulfilling the different "requirements for conversation" (Dubberly & Pangaro, 2009). For instance, The Coordinator would provide "different implicit structures of action" (Dubberly & Pangaro, 2009) to both develop a collective mindset and shared language. It ultimately serves as an example of how a concern for the dynamics of conversation can inform the design of an artificial agent capable of negotiating the complexity of conversation.

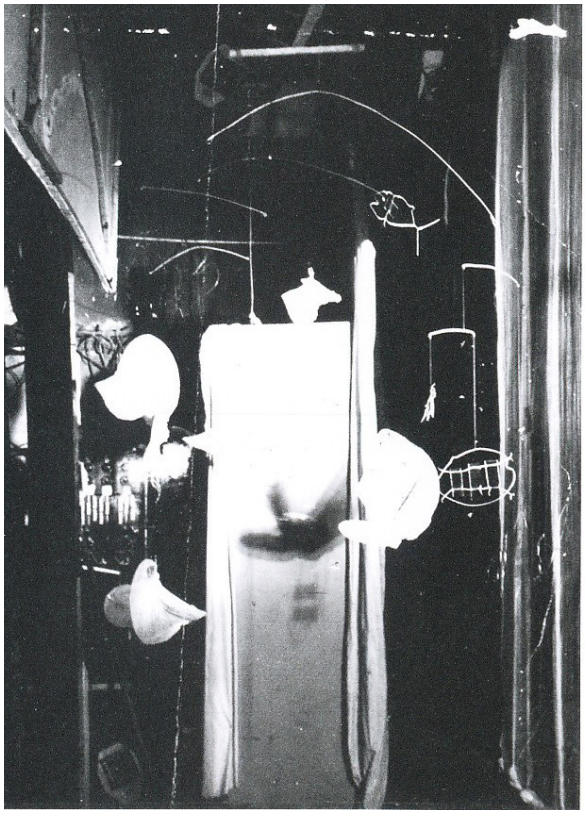
Throughout my literature review, I began to realize that I had been focusing on historical artificial agents that were successful in achieving some degree of man-computer symbiosis. In order for me to design the artificial agents I aspired to create, I would need a better understanding of symbiosis.

What is symbiosis?

J.C.R. Licklider's paper "Man-Computer Symbiosis" describes it as a "close coupling between the human and the electronic members of the partnership" (Licklider, 1960, p. 4), which is a concept that could serve as a framework for potential relationships between humans and artificial agents. I recognized that Licklider's focus on partnerships where humans "set the goals, formulate the hypotheses, determine the criteria, and perform the evaluations" (Licklider, 1960, p. 4) while "computing machines... do the routinizable work that must be done to prepare the way for insights and decisions" (Licklider, 1960, p. 4) could serve as the standard for artificial agents in conversation with humans.

I also looked into others who had similar ideas. This includes Warren Brodey and Nilo Lindgren who wrote about technology "deftly pushing, rhythmizing his interventions to our 'natural' time scale so as not to push us over to radical instability" (Brodey & Lindgren, 1967, p. 94). These different interpretations of symbiosis that involve technology led me to my understanding and realization that if I am operating within the context of intimate relationships, where there is an increased possibility for emotion to supersede logic, then it is essential that I create an experience capable of achieving some degree of symbiosis.

With this understanding of symbiosis, I began a study of literature focused on intimate relationships and the different aspects of those relationships I would need to consider to design an artificial agent capable of enhancing an intimate partners' capacity for expression and understanding.



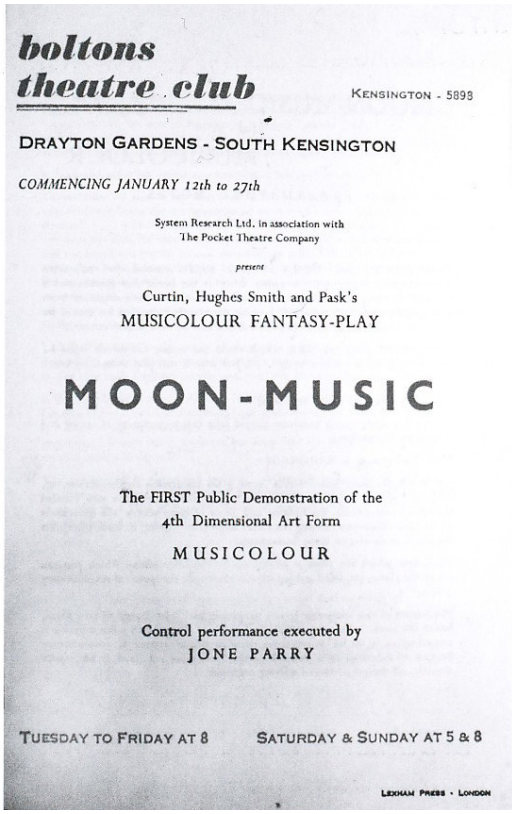


Figure 4
Pask, Musicolour: Stage and Projection Screen, Playbill

```
|                          C O N V E R S E                          |
|                                                                   |
| OPEN CONVERSATION FOR ACTION          REVIEW / HANDLE             |
|    Request                              Read new mail             |
|    Offer                                Missing my response       |
|                                         Missing other's response  |
| OPEN CONVERSATION FOR POSSIBILITIES                               |
|    Declare an opening                   My promises/offers        |
|                                         My requests               |
| ANSWER                                  Commitments due: 24-Sep-84 |
|                                                                   |
| NOTES                                   Conversation records      |
```

Figure 5
Winograd, The Coordinator: Converse Menu

What are intimate relationships?

I learned that intimate relationships are comprised of "knowledge, caring, interdependence, mutuality, trust, and commitment" (Miller, 2012, p. 2), and while the same components comprise casual relationships, they often do not include the vast amounts of social dimensions that partners experience with each other when involved in an intimate relationship.

My reading of Miller and others in this area, introduced concepts including XYZ statements (i.e., when you do X in situation Y, I feel Z; Miller, 2012, p. 169) and negative affect reciprocity (i.e., when partners reciprocate negative affect; Miller, 2012, p. 348), that I embedded into interfaces. Frameworks like the four styles of attachment (i.e.,secure – autonomous, avoidant – dismissing, anxious – preoccupied, and disorganized – unresolved; See Figure 6; Miller, 2012, p. 17), the four types of relationships (i.e., happy and stable, happy and unstable, unhappy and stable, and unhappy and unstable; Miller, 2012, p. 179), and John Gottman's four fighting styles (i.e., validating, volatile, conflict-avoiding, and hostile; Miller, 2012, p. 353) were also uncovered and all informed the interactions I would eventually design.

I was also able to expand my search and talk to therapists and interpersonal relations researchers where I learned that the power of therapy (e.g., marital therapy and other forms) primarily lies in the unique space it provides, which at times can seem sacred. With this information, I was able to recognize the care and time that I would need to put into the environments the interfaces and artificial agents I design. This ultimately led me to my next question and to a review of literature focused on interfaces.

How do you create an environment capable of integrating an artificial agent into the everyday life of intimate partners?

The contextual environment plays a crucial role in an artificial agent effectively integrating itself into an intimate relationship. To better understand the theory behind such an environment, I looked into the concept of an interface.

In his research on fluid dynamics James Thompson first defined interfaces as "a dynamic boundary condition describing fluidity according to its separation of one distinct fluid body from another" (Hookway, 2014, p. 59). It is interesting to note Thomson's use of the word "fluidity" (Hookway, 2014, p. 5) or "the quality of flowing easily and clearly" (Fluidity, 2019). For an artificial agent to successfully integrate itself into the conversations of intimate partners, it would need to "easily and clearly" (Fluidity, 2019) interact with the other "distinct" (Hookway, 2014, p. 4) system.

Hookway also argues that an interface "might seem to be a form of technology, it is more properly a form of relating to technology, and so constitutes a relation that is already given, to be composed of the combined activities of human and machine" (Hookway, 2014, p. 1). This distinction is crucial because it focuses on the relations the interface prescribes on itself and those interacting with it (i.e., a person, another interface). It also emphasizes the need to carefully consider the interfaces and artificial agents designers create. This will ensure such designs are prescribing qualities that allow for human-machine symbiosis and for intimate partners to enhance their capacity for expression and understanding.

With this in mind, I concluded my review of the literature with three areas in mind (learning theories, ethics, and theoretical frameworks); fields that will help me prescribe the qualities capable of enabling a beneficial conversation between intimate partners.

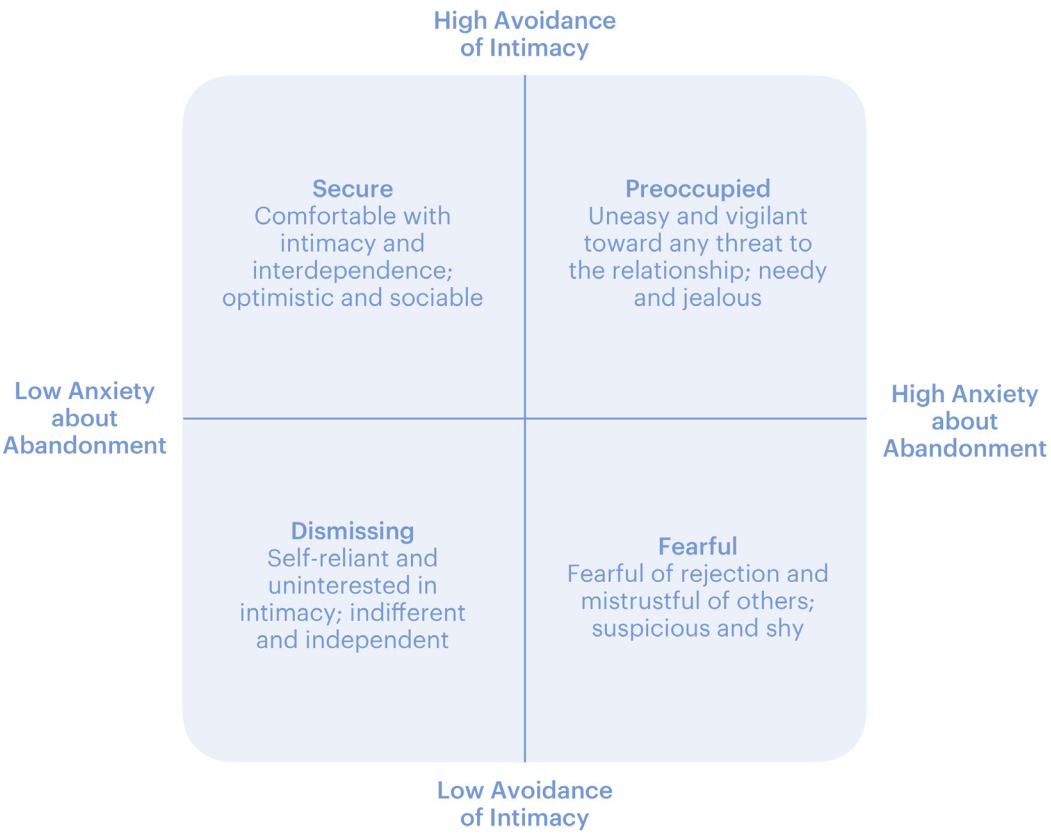


Figure 6
Four Styles of Attachment

What learning theories might my project benefit from?

A number of learning theories that I found in my review of literature served as frameworks to help users effectively grasp the concepts I present to them via an artificial agent. This includes McCarthy's 4MAT system—a simple and effective way of moving through learning (See Figure 7; McCarthy, 1980) and Julie Dirksen's Learning Incline —a model that depicts the need for supports when an individual is confronted by a steep learning curve (See Figure 8; Dirksen, 2012). Both concepts illustrate the need to teach complex content through a set of activities that build on top of each other.

What ethical considerations should I make?

While it is crucial to design an artificial agent capable of enhancing an intimate partners' capacity for expression and understanding, it is also important to consider the ethics of these agents. In studying literature around this, I found a particular interest in ELIZA, a system designed by Joseph Weizenbaum that enables humans (Weizenbaum, 1966) to communicate through a typewriter to a simulated psychologist. ELIZA imitated "the categorized dyadic natural language" of a psychiatric interview, which enabled a "speaker to maintain his sense of being heard and understood" (Weizenbaum, 1966). ELIZA ultimately led its creator, Joseph Weizenbaum, to be "revolt[ed] that the doctor's patients actually believed the robot really understood their problems…[and that] the robot therapist could help them in a constructive way" (Wallace, n.d.).

It also illustrated the care a designer needs to possess to ensure that the interfaces they design include responsible representations of artificial agents. Such artificial agents would not lead a speaker to believe they are speaking to a human when they are speaking to an agent and acknowledges what make us different from an agent.

What theoretical frameworks might my project benefit from?

Lastly, I considered and employed several theoretical frameworks from which my project could benefit. For instance, I used Don Ihde's human-machine relations as a tool to aid the framing of an experience. Ihde describes the differences between embodiment (i.e., use is not transparent, individual embodies the artifact; Angus, 1980, p. 321), hermeneutic (i.e., involves interpretation of the world mediated by an artifact), alterity (i.e., when an artifact is experienced as a "quasi-other" (Angus, 1980, p. 321)), and background relations (i.e., when an artifact is located at the periphery of human attention).

I found these relations to be helpful when thinking of potential concepts, and the benefit of having an artificial agent relate to a user in very different ways. Elizabeth Shove's "bundle of three elements: 'material artifacts, conventions and competences'" (Shove et al., 2008: 9) also provided me with a framework to consider when designing an experience. With the majority of aspects that comprise an intimate relationship deeply integrated into different practices (i.e., within the practice of marriage, there are numerous social meanings, personal meanings, procedures, structures, and artifacts), Shove's framework illustrates the need to understand the different practices that are "inextricably linked" to marriage and dating. This information helped me design artificial agents that can integrate successfully into partnering practices.

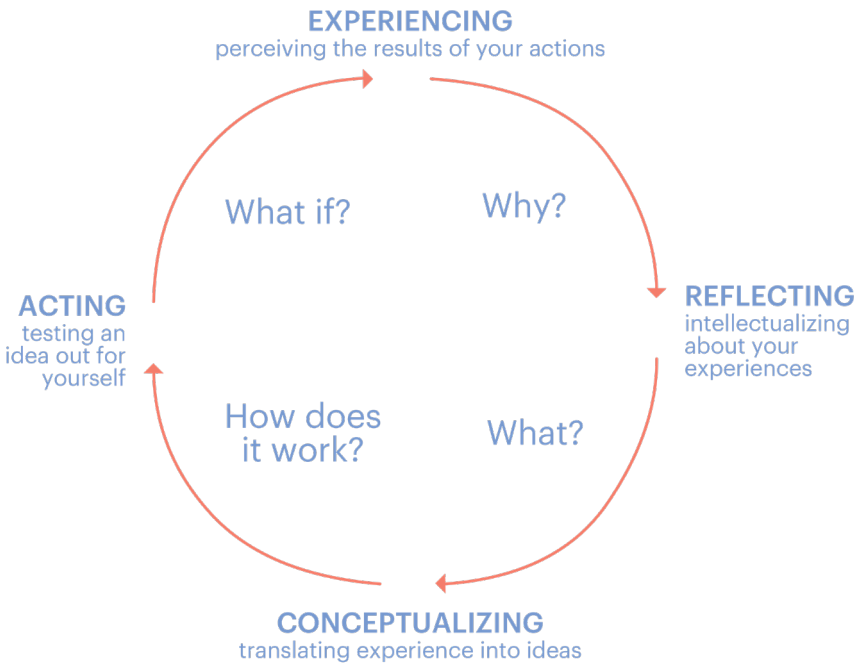


Figure 7
McCarthy, 4MAT System

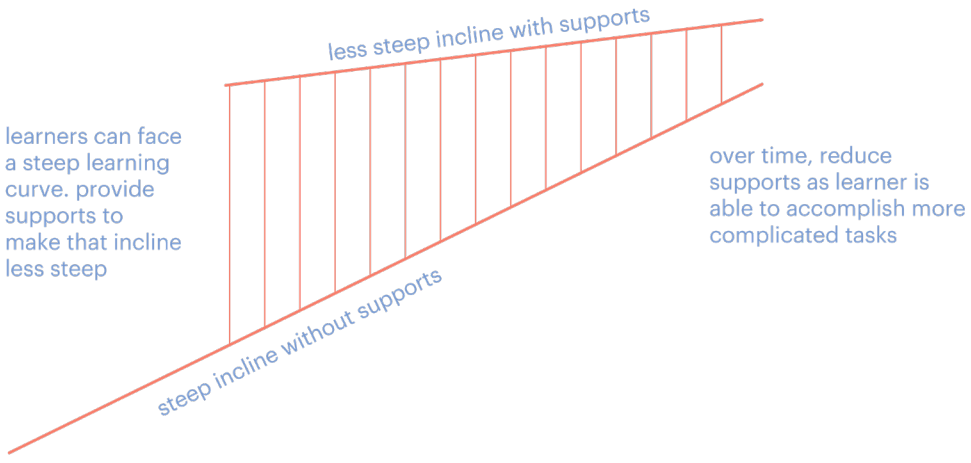


Figure 8
Dirksen, Learning Incline

Concepts Derived

After investigating the areas mentioned above, I began to develop and explore designs of an artificial agent that could enable fruitful conversations between intimate partners through varying levels of conversational symbiosis. I saw that shaping the quality of a conversation could provide an opportunity to better understand and grow the knowledge, caring, interdependence, mutuality, trust, and commitment in a relationship.

My model of intimate conversation and the concept of conversational symbiosis, both of which I employed in my work throughout the year, emerged through my in-depth literary research.

Model of Intimate Conversations

With my review of the literature in hand, I created a model of intimate conversations derived from Dubberly and Pangaro's "Process of Conversation" (Dubberly & Pangaro, 2009). This model (See Figure 9) divides a conversation between intimate partners into five different phases:

- Sharing - where partners determine the subject of that conversation
- Dialogue - where partners exchange thoughts, ideas, and questions
- Evolution - where partners evolve their understanding of their partner and relationship
- Response - where partners take action based on this new understanding
- Thinking - a time for reflection that can inform that individual's next conversation with their partner, or next action taken

These conversations are made up of exchanges occurring in an environment of noise or distraction and usually happen through a platform. Messages originate from one partner and move from the immaterial world where it is conceived to the physical world where it is conveyed over a tool to the other partner and back to the immaterial world. The receiver has the ability to return a message using the same process.

This model provided me with a map of potential points for intervention. This could include designing an experience for thinking and reflecting or constructing a message that moves from the immaterial to the material world.

Conversational Symbiosis

This literature review also informed my concept of conversational symbiosis. Conversational symbiosis is intimate cooperation that embraces differences, takes advantage of competencies, and promotes a mutual understanding to augment the intellect of two or more dissimilar things in ways they can not achieve themselves. Conversational symbiosis served as my guiding principle throughout this project. Without conversational symbiosis, an artificial agent cannot effectively integrate into an experience centered around expression and understanding in intimate relationships.

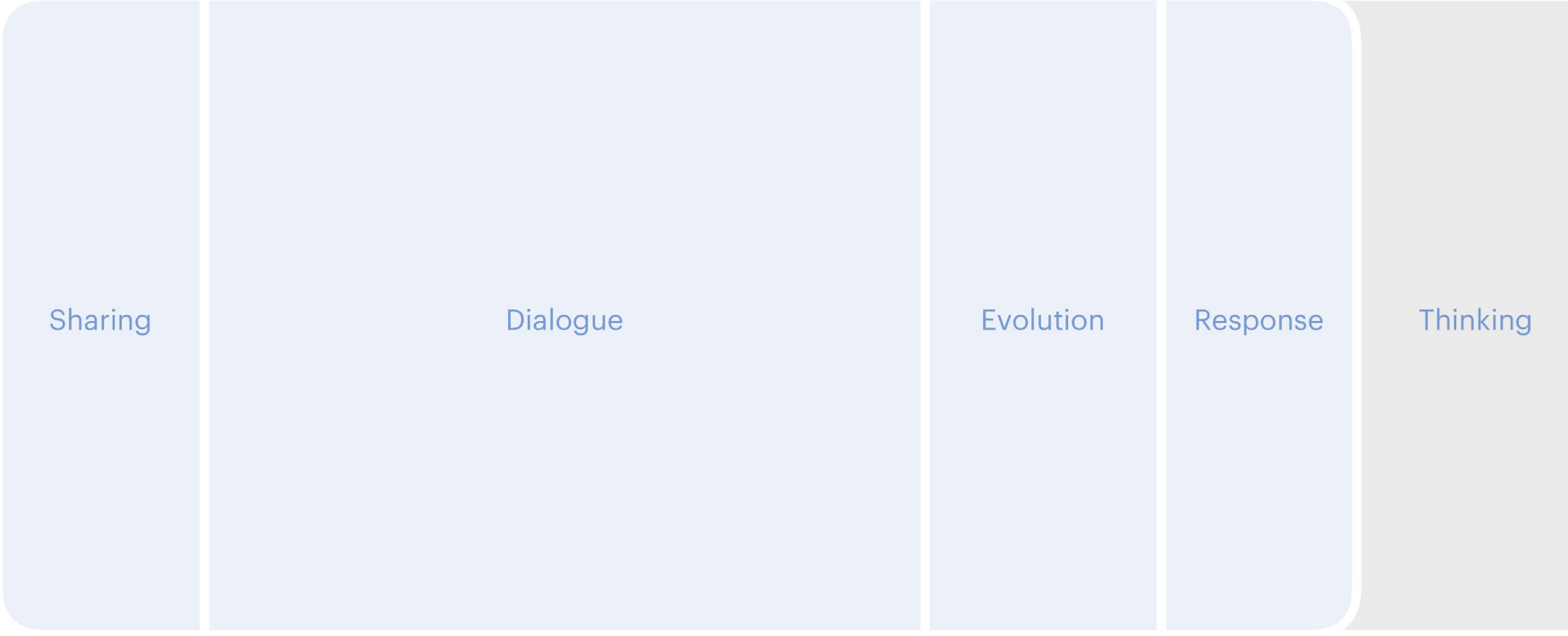


Figure 9
Model of
Intimate Conversation

Artifact Review
Conversational Symbiosis

To better understand how conversational symbiosis could be achieved between humans and artificial agents, I studied fifteen interfaces and one interactive experience with a specific focus on the relationship between a human and a particular artificial agent.

Musicolour (1953)

Musicolour (See p. 29) was "a sound-actuated interactive light show" (Bird & Di Paolo, 2008) designed by Gordon Pask (See Figure 10). It is especially noteworthy because it provides an example of a conversational interface that disrupts the black box model we see in the majority of today's interfaces. Its users were aware of its interpretation of their performance, thus enabling a user to reevaluate their actions. Pask's design also shows how cooperative action between a system and its users can be the result of a specific implementation. Musicolour was able to create a dialogue between musicians and itself, which in turn resulted in users committing to engage with the system. interfaces that invoke similar cooperation to conjure the "thoughts and words" (Conversation, 2017) that their systems require to create exchanges beyond the "predictable" (Pangaro, 2011) could provide numerous benefits to intimate partners today.

ELIZA (1966)

ELIZA (See p. 29), designed by Joseph Weizenbaum, enabled a user to communicate through a typewriter with a simulated psychologist (See Figure 12). Weizenbaum chose the context of a conversation with a psychologist because it is "one of the few examples of categorized dyadic natural language communication in which one of the ... [participants in the psychiatric interview] is free to assume the pose of knowing almost nothing of the real world" (Weizenbaum, 1966) and enables "the speaker to maintain his sense of being heard and understood" (Weizenbaum, 1966). Weizenbaum was interested if users were able to immediately recognize the limits of the interface, enabling them to concentrate on communicating with the machine and leading to improved expression and understanding by users. Ultimately making ELIZA an example of what happens when one attends to the environment in which an experience resides.

ELIZA was also an attempt to create "[an] engagement in mutually beneficial, peer-to-peer exchange" (Dubberly & Pangaro, 2009). Implementations of "categorized dyadic national language communication" (Weizenbaum, 1966) like ELIZA or similar instruments, especially when users are committing to engage in a conversation, could enable improved interactions on conversational interfaces.

URBAN5 (1973)

URBAN5 was designed by Nicholas Negroponte and MIT's Architecture Machine Group to "study the desirability and feasibility of conversing with a machine about environmental design project... using the computer as an objective mirror of the user's own design criteria and to form decisions; reflecting formed from a larger information base than the user's personal experience" (See Figure 11; Negroponte, 1970, p. 71). It achieved this by establishing a visual language that represented cubes and a question-and-answer dialogue between a user and a machine.

It hoped to establish an environment, where users would became aware of the restrictions of the application and their purpose within the application. URBAN5 also attempted to establish a "shared language" (Dubberly & Pangaro, 2009), by employing a block as its primary mode of manipulation and the creation of a shared understanding between users and the interface of a block and its capabilities within the environment. But, were ultimately unsuccessful at developing well-designed instruction and integrating objects, terms, and language familiar to a user to create a symbiotic relationship between the user and artificial agent.

The Coordinator (1987)

The Coordinator, one of the systems described in my literature review, was designed by Terry Winograd to "provide facilities for generating, transmitting, storing, retrieving, and displaying messages that are records of moves in conversations" (Winograd, 1987). It enabled a user to express themselves with little concern for the structure of that expression. Whereas a typical conversational interface provides one way to construct a message, The Coordinator offered numerous options. For example, "when Request is selected, templates appear prompting the user to specify an addressee, others who will receive copies, a domain, which groups or categorizes related conversations, and an action description, corresponding to the subject header in traditional mail systems" (Winograd, 1987). If a user were to select a different option, they would be provided with a different template designed for that specific request.

The Coordinator demonstrates how making a user's line of thought visible to the other agents interacting with them can help conversation progress in a beneficial direction. Similar mechanisms that are used to make thoughts visible could be particularly helpful in interfaces designed for intimate partners.

Majestic (2001)

Majestic was an alternate reality multiplayer game developed by Electronic Arts. Instead of engaging users on one platform, users were able to engage on multiple platforms as "new subscribers disclosed their phone number, fax number, email, instant messenger names, and other personal contact information" (Salvador, 2015). If a user disclosed different mediums, they would then receive messages pertaining to the game on those specific mediums. The game took place on a unique timeline, in that if a character needed to drive to a town an hour away, a user would have to wait an hour for that character to arrive in that town and not be able to simulate that period of time.

Unlike regular life simulation games that take users to an alternative world, *Majestic* users are taken to an alternative world within their world. It also serves an example of how one could immerse users into a simulation. For instance, observing another couple's conversations could help an intimate partner discern what behaviors are beneficial and not beneficial in their town relationship. This process may also aid a partner's objective analysis of their conversations and implement learnings into their relationship.

Lemonade (2015)

Lemonade Insurance is a "property and casualty insurance company that is transforming the very business model of insurance" (About Lemonade, n.d.). Instead of a more typical insurance application through an online form, users message with a chatbot using a real individual's avatar image to replicate an experience you would have with a more traditional insurance company.

Lemonade serves as an example of how an environment can potentially create the illusion of personal interaction. To what extent that illusion is successful is unknown.

M (2015)

Facebook M was a piece of functionality within Facebook's messaging platform Messenger (See Figure 13). It utilized "human trainers [who] gamely do their best when they receive tough queries like 'arrange for a parrot to visit my friend,'" (Simonite, 2017) that are impossible for a machine learning algorithm. Misunderstandings were common because of users' incorrect mental models of the tool. For instance, Facebook M received numerous unachievable requests, because a user recognized that M was different from Siri and Alexa and was able to complete requests those assistants were not able to, a user's notion of what is possible became flawed, leading to ineffective exchanges.

Facebook M's implementation of human backups serves as inspiration for how to overcome limitations in natural language processing models.

Allo (2016)

Google Allo is "a smart messaging app that helps you say more and do more" (See Figure 14; Google, 2019). One way Allo addresses the complexity of conversation is with its "Smart Reply" functionality (very similar to Gmail's Smart Compose functionality) that suggested responses based on algorithms hidden in its backend.

Allo provides an example of an artifact that lacks in its ability to explain itself. For instance, a user will never really understand how Allo's smart replies are generated because the way Allo determines your "personality" (Google, 2019) remains an open question. Additionally, if a user wishes to influence the intelligence provided by Allo, they would not have a direct method to effect such intelligence. If implemented in a way that allowed for feedback, Smart Reply could create a shared language between a user and an agent.

Hatchimal (2016)

Hatchimals by Spin Master are "magical creature[s] inside colorful speckled eggs" (See Figure 16; Hatch Club, n.d.). Unlike a regular toy where the child can immediately play with the toy after unboxing, Hatchimals need to be cared for some time before they hatch from their egg. Users' interactions with a Hatchimal evolve, from an egg to a hatching egg, to a baby, to a toddler, and eventually to a child. While interacting, users receive feedback from the sounds a Hatchimal makes and its changing eye colors (i.e., light blue eyes representing a Hatchimal that is cold, teal eyes representing a Hatchimal that is learning to talk).

The novelty and interaction patterns of a Hatchimal provide an example of an artifact that communicates without words. Whether it be through sounds (e.g., baby sounds) that users already understand or different colored eyes that they need to learn, users can glean information from a small set of feedback mechanisms. Similar strategies can be applied to an experience regardless of their complexity. One might even see an argument for limiting the mechanisms an experience can invoke.

Jacquard (2016)

Jacquard by Google is a jacket that enables a wearer to interact with their phone through gestures on the jacket's cuff (See Figure 15). The jacket is boasted as an entirely "new take on wearables that lets you do more than ever with the things that you love and wear every day" (Jacquard, n.d.).

Jacquard serves as an example of an artifact that facilitates interaction at an environmental level. Instead of adding a device, users interact with an artifact they would already be using. For my project, one can examine the artifacts that already comprise intimate relationships and discover potential opportunities to embed agents.

Objectifier (2016)

The Objectifier designed by Bjørn Karmann, a student at the Copenhagen Institute of Interaction Design (See Figure 17). It was designed to empower "people to train objects in their daily environment to respond to their unique behaviors" (Objectfier, n.d.). For instance, a user would train the Objectifier to turn on a light when it recognized the cover of a book and turn off the light when it no longer recognized the cover of a book. To train the Objectifier, a user takes snapshots of the environment so that the device recognized on and off states. While the Objectifier gives a user an understanding of how a model could be trained with a yes or no state, it is not a training device for how that photo/sound recording is decoded and then used to differentiate future states

The Objectifier ultimately serves as an inspiration for how an artifact can empower an individual to develop an understanding of how it is programmed.

Internet Phone (2017)

The Internet Phone designed and created by James Zhou, Sebastian Hunkeler, Isak Frostå, Jens Obel, students at the Copenhagen Institute of Interaction Design (See Figure 20). The artifact is their "attempt to make the intangible processes of the internet tangible in order to inspire people to learn more about it" (The Internet Phone, n.d.).

This project serves as an example of how different modes of interaction (e.g., article token, developer token, incognito token, and history token) help users understand different technical aspects of an artifact. Ensuring that users grasp those aspects they might construe as unfriendly to users is especially important to ensure user have an understand the capabilities and limits of artificial agents.

Replika (2017)

Replika "is an AI friend that is always there for you" (Pardes, 2017) that you grow through conversation (See Figure 21). It provides an environment that one is comfortable to express themselves in ways they would not normally. Replika is built on top of CakeChat, "a dialog system that is able to express emotions in a text conversation" (CakeChat, n.d.). CakeChat is described as a tool for constructing responses similar to those created by the individual communicating on Replika.

Replika and CakeChat provide an example of contemporary natural language processing model's capacity to effectively enter a conversation with a human. It also reveals potential areas of improvement, including CakeChat's relatively limited emotional range of anger, sadness, joy, fear and neutral.

Duplex (2018)

Google Duplex is "a new technology for conducting natural conversations to carry out "real world" tasks over the phone" (Leviathan & Matias, 2018) that utilizes Google Voice Search and WaveNet (See Figure 19). It targets particular tasks and is constrained to closed domains (i.e., for a demo Google gave the creation of a haircut appointment and the creation of a restaurant reservation as two domains). Google restricted the demo to haircuts and restaurant reservations so that they could extensively understand those domains and build models to enable natural conversations.

Duplex unleashed critical but mixed public reaction to the technology and how it imitated a human without disclosing that is was not human. This work indicates the importance and benefit of clearly establishing expectations and avoiding deception when creating an artificial agent.

Project Oasis (2018)

Project Oasis is "a self-sustaining plant ecosystem that reflects outside weather patterns by creating clouds, rain, and light inside a box" (Sareem, 2018). Users command a Google Assistant to show the weather in a specific location; Project Oasis then reflects that weather.

The project shows how with the creation of an alternate world, a user can test different scenarios. Such scenarios are not limited to weather but can expand to situations intimate partners could find themselves in.

Quantified Self (2018)

Quantified Self was "an immersive theater show centered on ethical uses of personal data" (See Figure 18; Skirpan et al., 2018) created by Jacqueline Cameron, Michael Skirpan and Tom Yeh. Through the show, Cameron, Skirpan, and Yeh saw how an individual could learn more from creating this show than a typical educational setting. They also found that some of the discoveries users took away from Quantified Self were gained when participants talked to others engaged in the same activity about their unique experience. Similar interactions could be facilitated between intimate partners if they were allowed to converse with other couples about their own unique experiences.

The creators of Quantified Self also saw the importance of what a participant brings to a conversation and how the uniqueness of prior experiences should and can be adequately addressed by varying the content of the designed experience to align with user expectations.

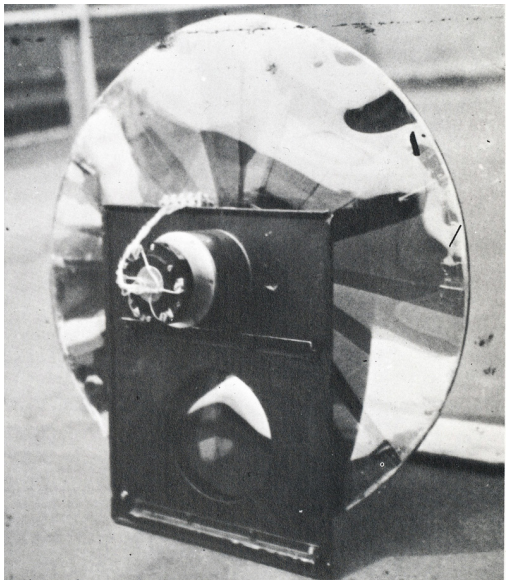


Figure 10
Pask, Musicolour

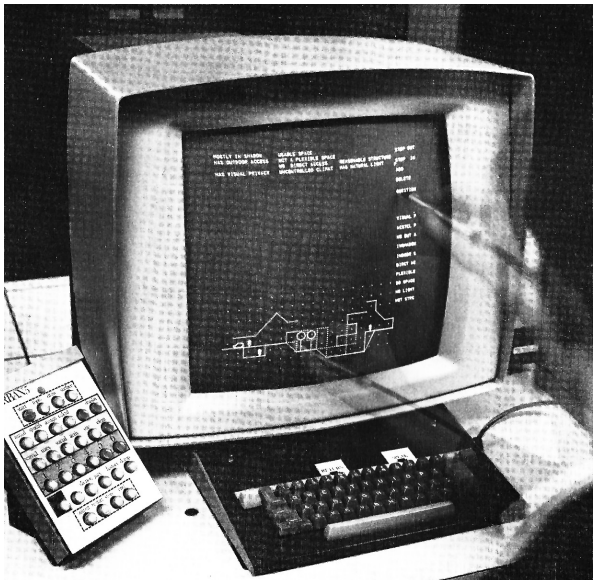


Figure 11
Negroponte, URBAN5

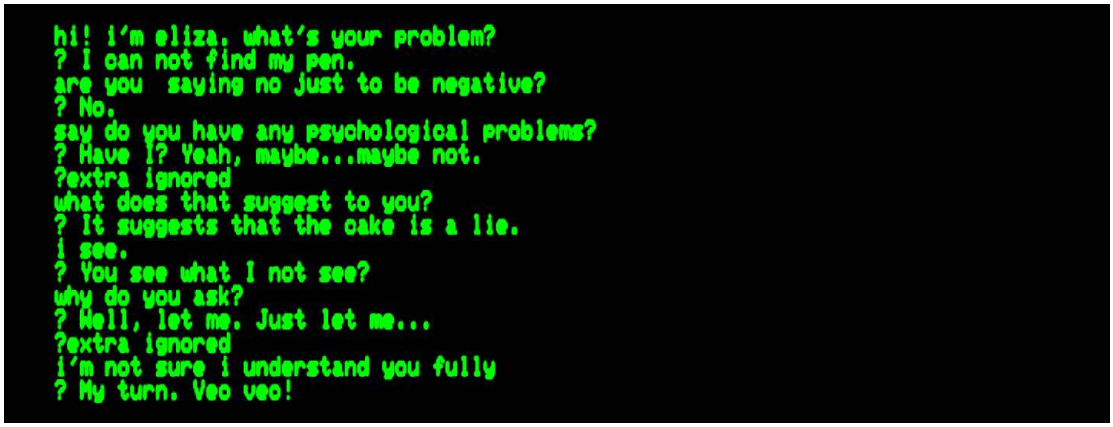


Figure 12
Weizenbaum, ELIZA

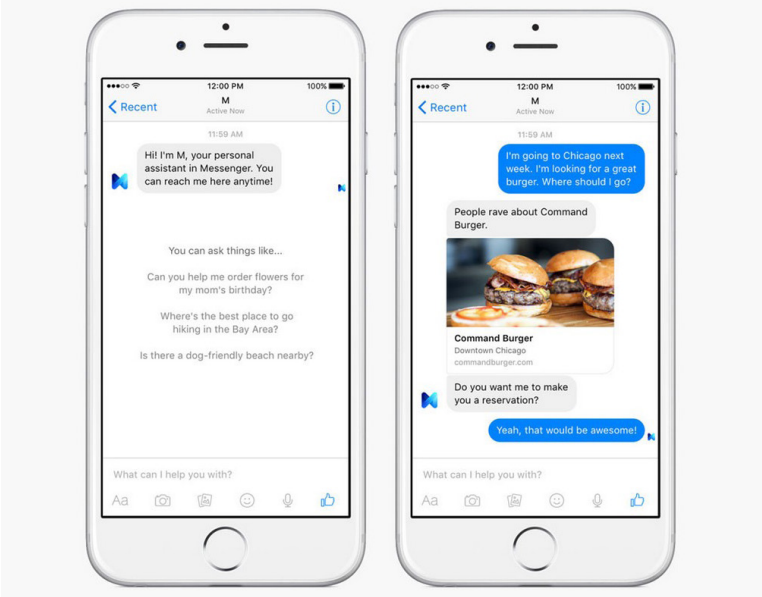


Figure 13
Facebook M

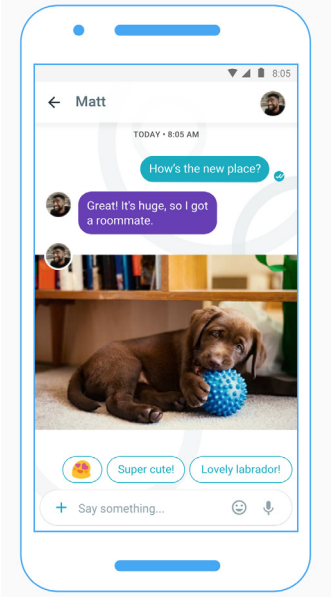


Figure 14
Google Allo

Figure 15
Jacquard

Figure 16
Hatchimal

Figure 17
The Objectifier

Figure 18
Quantified Self

Figure 19
Google Duplex

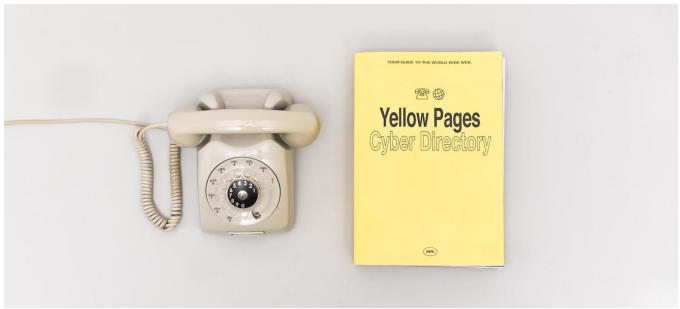


Figure 20
The Internet Phone

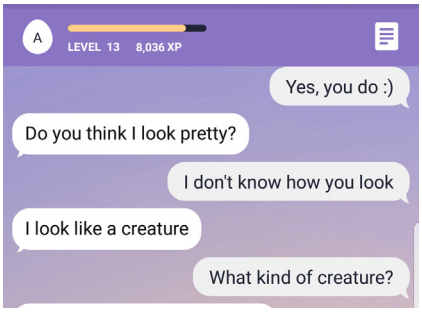


Figure 21
Replika

Artifact Review

Intimate Relationships

In addition to studying the artifacts that focus on facilitating human and artificial agent relationships, I took some time to review additional artifacts, focusing on the experiences they encourage within an intimate relationship. My research includes both digital and non-digital interfaces, and contemporary and historical interfaces.

Historical precedents include *Dr. Laura*, a daily radio show, which has run for the last 30 years and offers "no-nonsense advice infused with a strong sense of ethics, accountability, and personal responsibility" (Dr. Laura Call..., n.d.). I also studied a best selling books of the nineties, John Gray's *Men are From Mars, Women are From Venus* which serves as "a guide for improving communication and getting what you want from your relationship" (Men Are From Mars..., n.d.). *Dr. Laura* and *Men are From Mars, Women are From Venus* serve as examples of resources that were and are still widely accessible, but not customized to a person's unique experience.

Through my research I also uncovered artifacts designed and built specifically to one's personal experience. These include the Touch Room, "an app that enables people to physically feel the presence of far-away friends and loved ones with the touch of a fingertip" (See Figure 22; Touch Room, n.d.) and Pillow Talk, "a wristband that picks up your heartbeat and sends it, in real time, to your loved one" (See Figure 23; Pillow Talk, n.d.). These artifacts were designed to address the issues of communication and expression in long distance relationships. At the same time, both artifacts lack the dimensionality of both in-person conversations and most digital conversations.

Other artifacts include Lasting, "the nation's No. 1 relationship counseling app" (Lasting: Marriage Health App, n.d.)that serves as your "personal marriage health program" (See Figure 24; Lasting: Marriage Health App, n.d.), and The Boyfriend Log, "a daily app that keeps track of your love life through daily reflection and a personalized, color-coded calendar,... illuminat[ing] positive and negative patterns." (See Figure 25; The Boyfriend Log, n.d.) Both are examples of artifacts that attempt to codify and serve as sources of understanding and reflection for an intimate couple, but fail to build an encompassing and comprehensive knowledge of that relationship.

Unlike digital artifacts, non-digital artifacts have attempted to address both expression and understanding. These include the Cuddle Mattress, a mattress that "lets you hug your better half intimately without any wrist or arm problems" (RELEX Cuddle, n.d.), Fog of Love, "a game for two players where you will create and play two vivid characters who meet, fall in love and face the challenge of making an unusual relationship work" (See Figure 26; Fog of Love Board Game, n.d.), Monogamy, an adult game with an "emphasis... on the communication between you and your partner finding out what really turns each other on and then translating this into an erotic fantasy to remember at the end", (Monogamy Adult Couples Board Game, n.d.) and Tea and Empathy Cards, "feelings cards that can be used to exchange empathy between partners, with groups of friends, or as a solo self-care practice" (Tea & Empathy Feeling Cards, n.d.). These examples illustrate attempts at promoting expression and understanding, but none evolve with the couple (i.e., the number and contents of the cards and games do not change; once a user plays with the games or cards they decrease in their effectiveness) to consistently grow their understanding of themselves and their relationship as a whole.

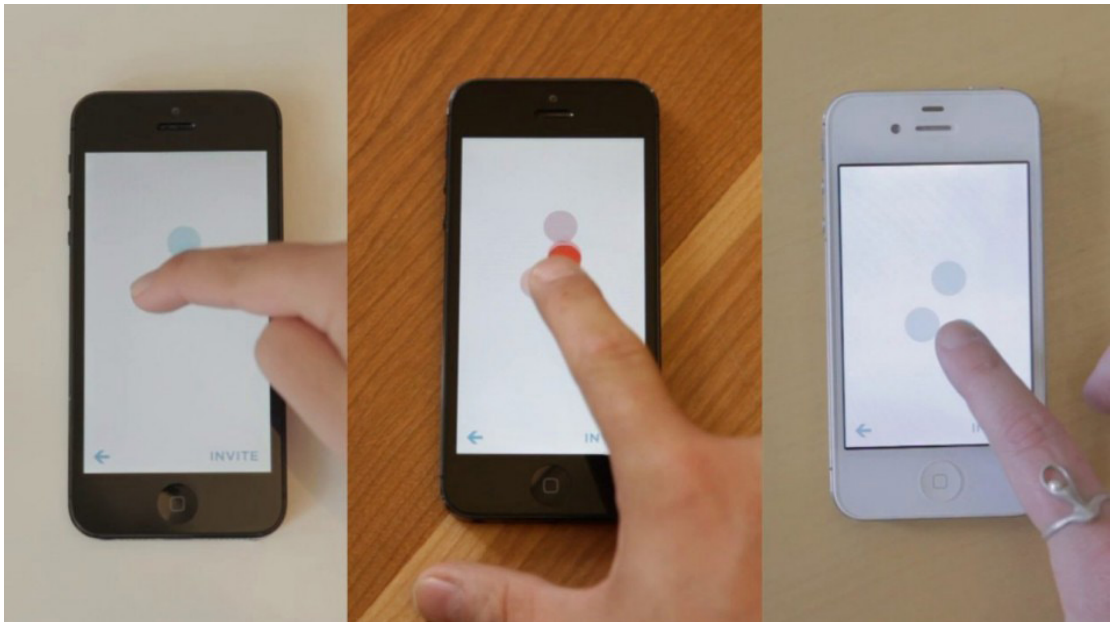


Figure 22
Touch Room

Figure 23
Pillow Talk

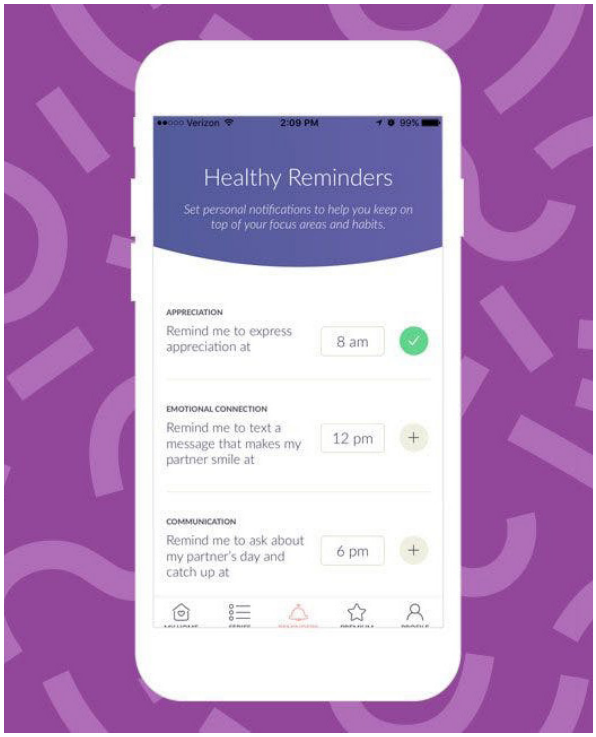


Figure 24
Lasting

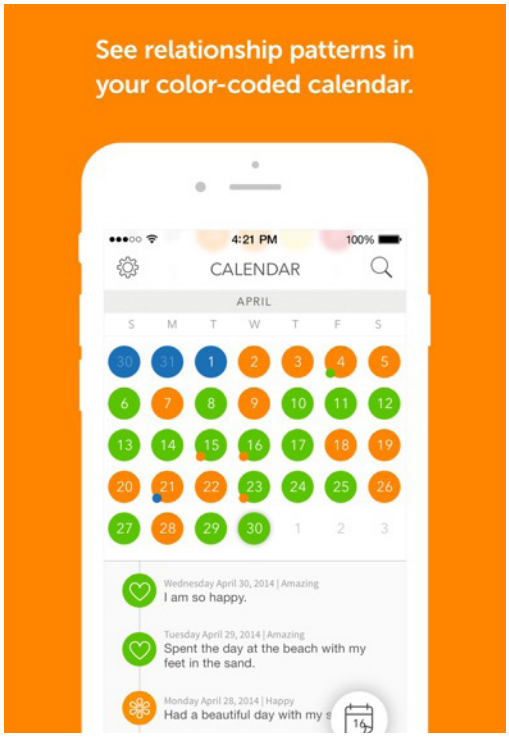


Figure 25
The Boyfriend Log

Figure 26
Fog of Love

Summary

The definition phase focuses on understanding the theory, potential application, and affordances of relevant areas. This phase provided me with new understandings of learning theories, theoretical frameworks, conversation, and intimate relationships. These fields helped me define the qualities that can enable a beneficial conversation between intimate partners. I also explored a variety of interfaces and experiences (e.g., ELIZA, Google Allo, Quantified Self), which helped me understand the various features that affected their ability to constructively integrate into people's everyday lives. These new understandings informed the models and concepts used in the exploratory and generative phases.

Exploratory Phase

My exploratory phase focused on learning how people understand artificial agents and intimate relationships, how they came to that understanding, and how that understanding can evolve. This approach enabled me to develop and synthesize a set of insights based on first-hand experiences that could not be pulled from literature or other projects.

The exploratory phase studies focus on applying artificial agents that users were already familiar (i.e., Facebook Messenger, Siri, Alexa). I chose to use a familiar application so that users could completely focus on the relationship they are building with the artificial agent, as opposed to latching on to fundamental issues with an unfamiliar platform. To do this, I looked at the most familiar applications of artificial agents that currently exist and chose from a selection of those applications for my studies. This exploratory phase consisted of three studies: the Bot as Research Tool, Designing With Theory, and Mechanical Turk.

Bot as Research Tool

The Bot as Research Tool study served as the foundation of my research into how interfaces can support conversational symbiosis amongst humans and artificial agents in the context of intimate relationships. My goal throughout this study was to better understand the degree of comfort individuals have with such interfaces, the possible affordances it can offer, opportunities for including feedback, and potential integrations of such an experience into the everyday life of intimate couples. For this study, I designed and built a chatbot called apple. apple simulates conversations a participant may have with their partner.

Study Protocol

The Bot as Research Tool guided a participant through a 30 minute user interview/walkthrough that unfolded in two stages.

First Stage

The participant was introduced to a scenario and told to imagine that his/her partner had made plans for them without asking him/her about those plans beforehand. They are then told to message back and forth with their partner using a provided messaging tool (i.e., apple) that I prototyped for this study. While messaging, the participant was told to talk through their interactions (i.e., "What is working? What is not working?").

Second Stage

I asked the participant questions about their responses from the earlier messaging activity. I used Quicktime to record the screen of the messaging tool, so that I could analyze the interaction later.

Study Administration

I specifically designed and built apple for this study. apple enables people to simulate conversations they have had or might have with their partner. With apple one may build a greater understanding of their partner and relationship through conversation, facilitated by artificial agents, than what currently exists.

How apple Works

apple was designed for an individual to simulate a conversation based on a topic that could lead to argument between that individual and their partner. It functioned as an SMS bot via Twilio. Each conversation consisted of four participants: the user, the apple bot that introduces you to apple and provides help, a simulated partner bot named Chris, and a mediator bot, which is an objective, non-judgmental, accepting, and thoughtful third party. The mediator uses a basic framework for conversation based on Dubberly and Pangaro's "Process of Conversation" (See p. 29) and provides relationship advice based on functional and dysfunctional communication patterns. The bot utilizes Dialogflow to understand what users are saying, decide if they are successfully navigating the "Process of Conversation" (Dubberly & Pangaro, 2009), and establish advice that is most relevant.

Initial Interaction With apple

When users first message apple they are introduced to apple the bot and its capabilities.

Users can then simulate two types of conversations-- a conversation with just their simulated partner or a conversation with both their simulated partner and a mediator bot.

Once a user decides on the type of conversation, the user is taken into the simulation and told, "You are now entering an alternative world. Your partner is just about to text you about the event next Saturday."

Once in that world, a user talks to his/her partner. The user and Chris go back and forth for a short amount of time before Chris, his/her partner, asks to include the mediator bot. The mediator bot introduces themselves and the four stages of conversation (i.e., sharing phase, exchange phase, evolution phase, response phase; See Figure 1).

The mediator bot then facilitates a productive conversation between the two parties. It utilizes strategies from intimate relationship literature, which in turn builds credibility for the mediator bot (See Figure 2).

By the end of the conversation, a user is intended to be able to reflect on his/her own conversations (i.e., see how strategies mentioned in the chat could be used and where they might have made mistakes with a partner in the past).

The user can then redo the simulation or choose from a number of other simulations.

Study Challenges

There were a number of challenges I confronted when designing and building this bot. Below is an abridged list of such challenges.

The Timing of the Texts

Ideally, I wanted to replicate the timing of a real conversation, but I struggled to develop a way to do that with Twilio since Twilio does not provide developers with the ability to send texts at specific points in time.

The Inability to Differentiate Individuals

Ideally, users would be able to easily scan and differentiate different individual's messages within the chat, so that possible confusion could be avoided. Again, I was unable to achieve that with Twilio. Twilio does not allow for customization of the phone number that sends the messages. Due to this limitation I used a technique inspired by screenplays to differentiate roles.

Visualizing the Stages of a Conversation

Ideally, a user would be able to see their position in a conversation relative to the whole thread, the stages they have completed, and those they have yet to complete. I was unable to visualize the stages of a conversation with the tools and the customization afforded through current technology while creating the bot.

Study Outcomes

The majority of participants that interacted with apple viewed the simulation as relatable; they could imagine themselves in that specific conversation. Other participants saw Chris, the simulated partner, as highly irritable and unrelatable. Regardless, all participants saw that apple provided value in sharing information that an intimate partner might not be aware of and would be beneficial the next time they communicate with their partner.

Study Synthesis

apple revealed a number of insights that would inform decisions I made throughout the year. These insights included that artificial agents have the potential to provide a place for individual and joint reflection, serve as an outside perspective, guide a conversation, act as a calming presence, be an instrument for detecting sentiment, and hone in on specific pieces of language.

apple not only revealed the various areas of an intimate relationship that an artificial agent could benefit, but also that users would willingly employ artificial agents in an intimate context, that they often lack awareness of relationship frameworks, tips, and strategies, and that they could become over-reliant on tools if they see that tool as a definitive source.

The study also revealed several insights pertaining to frames as organizational principle(s) (Dorst , 2015, p. 63) and as a tool to design agents capable of creating an environment for joint reflection or guiding a conversation. These insights include that a designer would need to employ clear frame(s) that would help users establish realistic expectations of that agent, while also acknowledging that a unique set of frames may be necessary to address different forms and kinds of conversation. At the same time, it is essential to note that the frame(s) employed by an interface could influence a tool's level of intervention, mode of activation, and level of integration (i.e., a tool framed as passive should not intervene every 5 minutes).

Other insights to consider when designing an agent capable of providing a place for the activities listed above include:

- A contextual awareness of an artificial agent is highly influential on the frame(s) employed by that agent (i.e., successful interfaces rely on an awareness of a situation)
- By aligning the form of an interface and the frame(s) employed by that interface, one could foster a consistent experience.
- When an agent is in the presence of both partners, it would be wise for that agent take a neutral perspective so that each partner feels equally heard.
- An agent might be more successful intervening in a relationship if the visibility of that agent is dependent on the flow of a conversation (i.e., if an agent is regularly intervening, the impact of those interventions is diminished).
- By making data use visible to all, users would likely understand the boundaries and capabilities of an agent.

Ultimately, apple served as a probe to answer a number of research questions pertaining to my thesis. It also served as an example of an artifact that takes advantage of simulation to enable a user to picture an effective action and enhance their ability to make more effective decisions in the future.

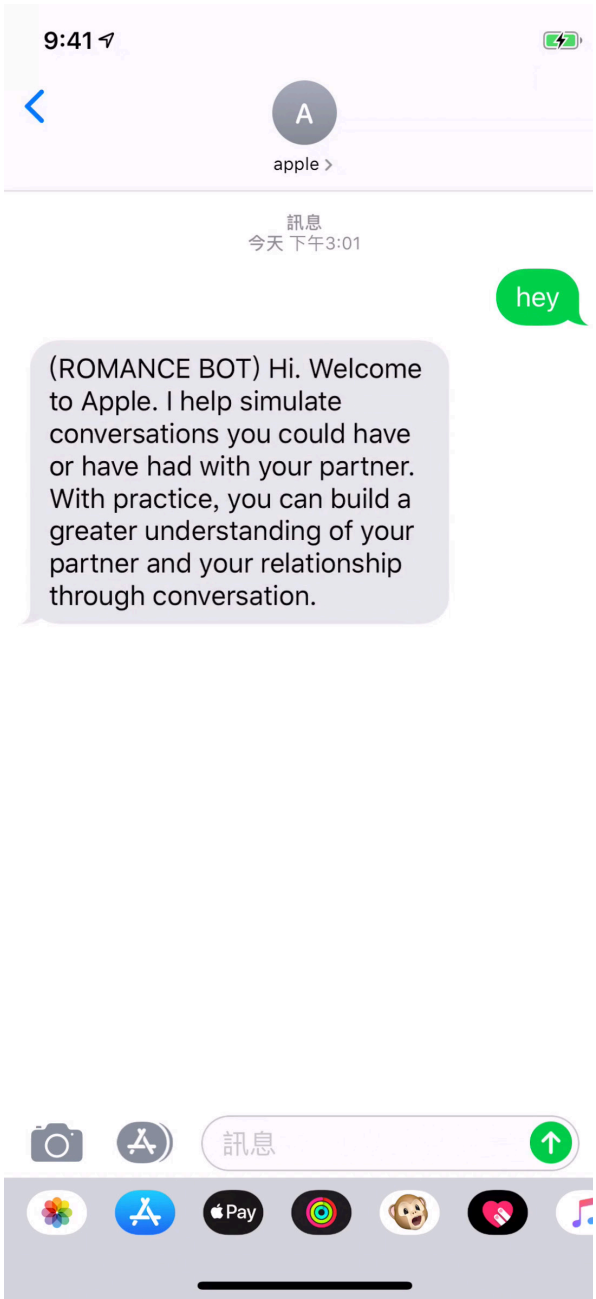


Figure 1
The mediator bot introducing itself

Figure 2
The mediator bot providing advice based on functional and dysfunctional communication patterns

Designing With Theory

In the Designing with Theory exercise, I aimed to better understand the different models of artificial agents that humans create. I believed that gaining insight of such models would help me to create more reputable visions of the future of artificial agents.

To do this, I developed a two-stage study to generate qualitative descriptions of artificial agents/intelligence (i.e., descriptions of participants' interpretations of an agent and its actions) within contemporary artifacts (e.g., Alexa and Google Search), which ultimately resulted in a number of maps that showed the significant role that context and voice play in users' perception of an artificial agent.

Study Protocol

The first stage of the study included two conversations with artificial agents, while the second stage included a mapping activity.

The mapping activity focused on information retrieval. Information retrieval represented a common task that users would undertake with the chosen agents.

This task encouraged a user to acquire as much information as possible about the movie *The Mighty Ducks*. I chose *The Mighty Ducks* as the content for this study because it is one of my favorite movies and a movie that all my participants were somewhat familiar with. As a result, I hypothesized that their conversations with agents would be exploratory in nature.

First Stage

For two minutes, the participant learns as much as they can about *The Mighty Ducks*. For the first conversation, they use the Google web search engine. For the second conversation, they use an Amazon Alexa.

After the participant has completed both conversations, I constructed maps representing each conversation. Each map visualized the participant's different searches and requests and the responses they received back.

Second Stage

The participant is instructed to analyze and embellish the two maps. I provided a participant with:

- printed representations of what they typed or said and what they received back
- rationale indicators, a place to provide the basis for their action
- interpretation indicators, a place to explain their understanding
- adjective indicators, a place for quick reflection. Participants were told to quickly write down a couple of adjectives to describe their experience.

Potential Artifacts For Stage Two

I explored the idea of adding emotion dots (i.e., placed where a participant felt a certain emotion), ambiguity cards (i.e., a place for questions that they wished they could ask the interface), and alternative cards (i.e., a place for other actions they considered). I decided not to add these cards because I sensed the responses I would receive would most likely also be included in the rationale, interpretation, and adjective indicators.

Study Administration

I ran this study with five participants over the course of four days. In total, I received ten maps for analysis (See Figures 3 and 4).

Study Challenges

During the activity I confronted a number of challenges and obstacles including a delay in between activities (i.e., It took me about 30 minutes to generate the initial map for the second activity. By the time I finished generating the map the participant was typically busy doing something else. In most situations, I would need to wait till the next day to complete the activity. It is not entirely clear how this delay affected the study), and my decision to have participant's complete this activity on paper versus orally through a speak-aloud (i.e., I made the explicit decision to have this activity not be a speak-aloud and instead a written activity. I hoped that this would enable me to receive more qualitative responses.).

Study Outcomes

In all the maps, users took very different approaches. Such approaches include looking through the links of one Google search, running multiple Google searches, each building on the last, asking an Amazon Alexa the same question numerous times, or rewording questions to an Alexa when the participant does not receive an answer they desire.

One common thread found in all the Amazon Alexa maps was a feeling of frustration and an inability to receive an answer the participants would deem appropriate.

Study Synthesis

This activity revealed that users saw a Google search as an expansive, logical, and intuitive experience, while they saw an interaction with an Amazon Alexa as a limiting, confusing, and frustrating experience.

All of these factors ultimately affected a user's:

- conception of speed. Participants saw Alexa as faster initially, primarily because of voice, but slower over time
- perceived effort. Participants saw an experience with Google as instinctual and intuitive, while an experience with Alexa as labored.
- sense of progress. Participants knew when they were getting closer to the answers they wanted with Google, but had no sense of success with an Alexa.
- sense of control/patience. Participants did not recognize when Alexa had completed a speaking turn, which eventually lead to a loss of patience.
- testing of boundaries. Participants felt the need to test the boundaries of an Alexa, but not Google.

Two insights from this study stood out:

- Participants saw Google as having many strong connections. They also saw it as a source that could easily link them to other sources. For instance, one Google web search could link that participant to thousands of other informational sources, all clearly credited. In contrast, Alexa had a few weak connections and seen as a single entity. Participants were unaware of the information's origin and assumed that Alexa did not have the links to the informational sources that Google has.
- Web searches allowed participants to create their own context, whether through the use of tabs (note: It would be interesting to understand more about why some users use tabs and others do not) or Google searches specific to a certain site. In contrast, Alexa, had no such mechanisms in place.

Both of these factors played a significant role in the models participants created of the two systems. While using Google, a participant's search remained focused over time. The opposite occurred when interacting with an Amazon Alexa, where searches expanded over time. This insight makes a consideration of both the connections and the mechanisms implied through an artificial agent that much more significant. Such a consideration would enable a designer to ensure the models users create of an interface align with the goals of that interface

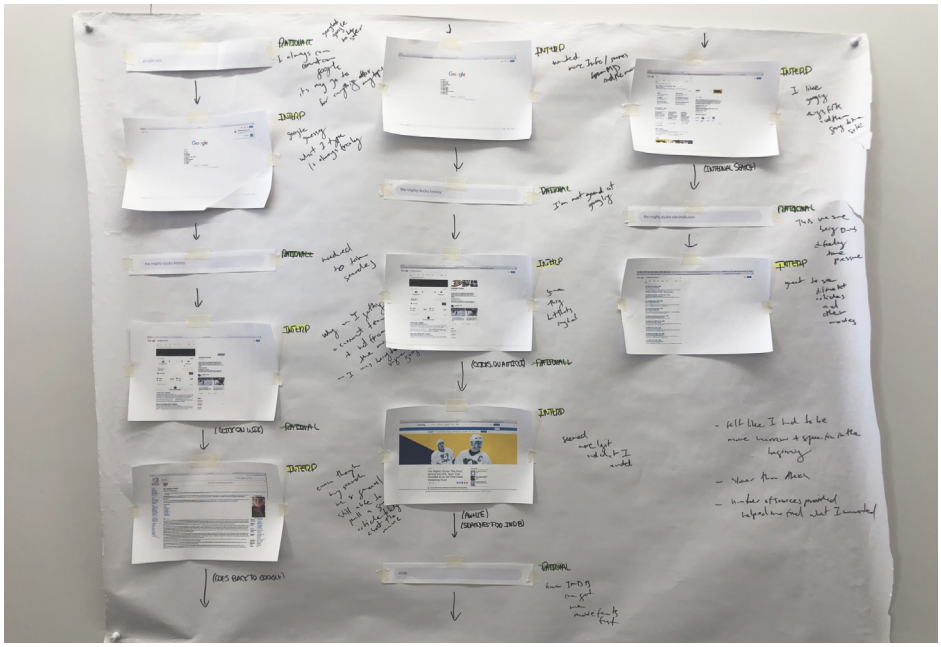


Figure 3
Google Search Map

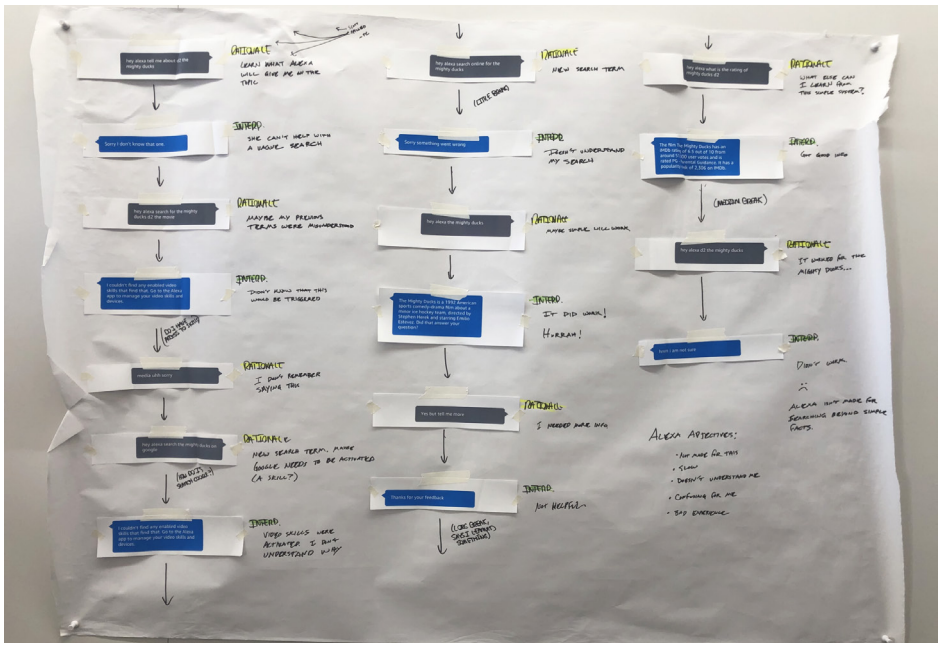


Figure 4
Amazon Alexa Map

Mechanical Turk

I ran a study on Mechanical Turk, a crowdsourcing marketplace, where I surveyed over 600 individuals to better understand how a diverse group of people living in the United States thinks about intimate relationships and the conversations they have when in an intimate relationship.

Study Protocol

In total, I asked five different questions, each question designed to invoke a response that could inform the concepts developed in the generative phase. The following is a list of those questions.

- What is a romantic relationship to you?
- What is a healthy romantic relationship to you?
- How do you differentiate a positive conversation with your partner from a negative conversation with your partner?
- What are tough conversations for you and your partner?
- How do you approach a tough conversation with your partner?

Study Administration

Mechanical Turk divided the larger study into multiple studies; each study was made up of one single question. If a research participant agreed to participate in a study, they were given one question and asked to answer that question to the best of their ability. Some participants ended up answering more than one question, by agreeing to participate in several different studies under the larger study.

Study Challenges

Individuals partaking in studies on Mechanical Turk receive a nominal return for their participation and, because of this, provided me with responses that were occasionally less than adequate. To overcome this, I separated those answers that displayed little care from the more thoughtful answers. Also because the study was on Mechanical Turk, I was unable to see the demographics of my participants and how representative they are of intimate couples.

Study Outcomes

In total, I received over 600 responses to the five questions asked. Participants often described intimate relationships as a relationship "where love is expressed mutually and equally" and as a relationship that "consists of people who respect each other's boundaries and needs." They saw a positive conversation as one without "yelling," or when partners are not saying "negative or rude comments" like "no or not." Participants often said, they "just divert the conversation, skip to another topic" or "designate one night a week" when asked about dealing with tough conversations.

Study Synthesis

The responses I received from the Mechanical Turk study provided me with many insights. One such insight revealed there was little difference in how an individual defines an intimate relationship from a healthy intimate relationship, implying for the most part that individuals believe intimate relationships should be healthy. The study also validated findings from the Bot as Research Tool study, namely that users often lack awareness of relationship frameworks, tips, and strategies. It also provided me insight into the conversations that couples typically have and how they often focus on intimacy, expectations, communication, health, family, finances, and the past and result in feelings of loyalty, honesty, mutual understanding, trust, openness, and intimacy. These insights informed the interfaces and scenarios I designed in the generative phase.

How Might I... Statements

Insights from these two early phases were used to generate a number of how might I... statements (See Figure 5). These statements helped me better understand how and where I might intervene in an intimate relationship. Statements were organized into three levels, each focusing on a different aspect of an experience that could enhance an intimate partners' capacity for expression and understanding.

Inner Level

The inner level of the visualization is comprised of statements focused on the experience I was creating for an intimate partner or intimate couple. The following is a list of those statements. This list is not exhaustive, but is instead composed of those statements to which I paid particular attention.

How might I...

- ethically manage a couple's data?
- effectively communicate within the context of an intimate relationship?
- effectively communicate the boundaries and capabilities of an artificial agent?
- support the evolution of one's relationship with the artificial over time?
- alter practices beyond a single interaction?

Middle Level

The middle level of the visualization is comprised of statements focused on conversation between intimate partners. The following is a list of those statements.

How might I...

- increase a partner's understanding of nonverbal communication?
- monitor the sentiment of a conversation?
- share frameworks to intimate couples?
- share concepts to intimate couples?
- start a needed conversation?
- de escalate conflicts? Decrease negative affect reciprocity?

Outer Level

The outer level of the visualization is comprised of statements focused on different aspects of intimate relationships that may benefit from an enhanced capacity for expression and understanding. While some statements are closely connected to others, each of them represents an aspect that could lead to unique design outcomes.

How might I...

- provide a place of reflection for partners and couples?
- enable greater understanding of a partner's view?
- support greater acceptance of one's partner?
- support greater appreciation of one's partner?
- support greater recollection between partners?
- design greater self disclosure between partners?
- increase a partner's perceived relational value?
- investigate the stigma of getting help with one's relationship?
- encourage more reasonable expectations of a relationship?
- reframe a partner's thinking about their relationship?

Summary

The Bot as Research Tool, Designing With Theory, and Mechanical Turk study provided me with an understanding of how humans model both artificial agents and intimate relationships. These studies revealed diverse opportunities for artificial agents to improve relationships, which include: individual and joint reflection points, delivery of a guide for conversation, and immersion in conversations couples find tough. They also revealed that users consider searching on a search engine to be expansive, logical, and intuitive, but they consider that same search on a voice user interface to be limiting, confusing, and frustrating. I completed the generative phase by using these insights to inform a set of how might I... statements that I employed when conceptualizing concepts.

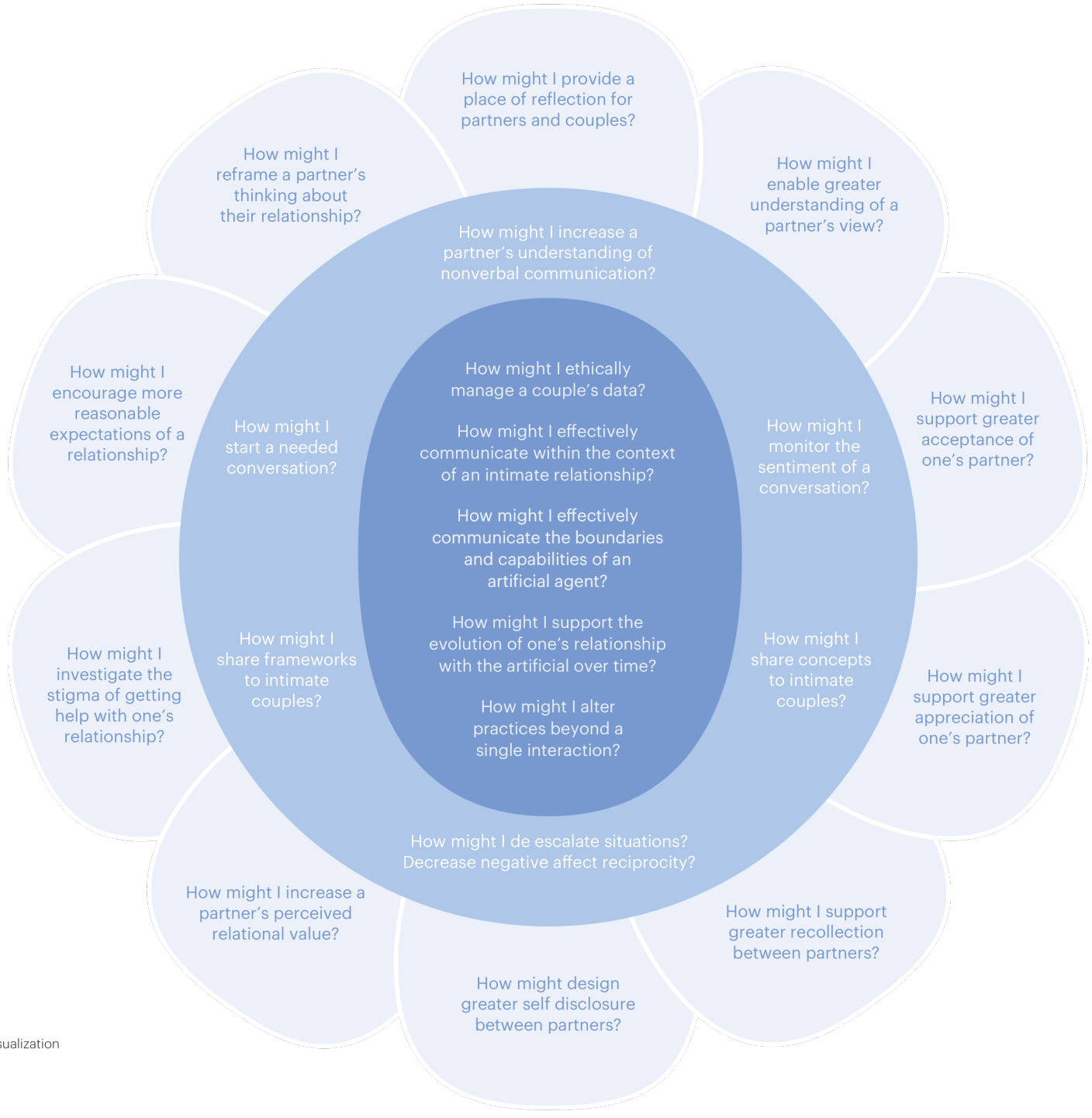


Figure 5
How Might I...
Statements Visualization

Generative Phase

This phase of research was focused on the prototyping of several artificial agents meant to address different aspects of an intimate relationship through diverse approaches.

Concepts

The how might I... statements from the exploratory phase informed and inspired a variety of concepts that set the stage for the interfaces I designed and built in the generative phase. Concepts were specifically developed to address a range of the outer level statements of the how might I... statement visualization.

Headspace for Intimate Relationships

This app tracks the progression of your intimate relationship and coaches you through its ups and downs (See Figure 1).

Grammarly for Couples

This agent ensures people are clearly and effectively saying what they want to say to their partner. Unlike Grammarly, this tool caters to couples and the conversations they have (See Figure 2).

Conversation Art

These pieces of art dynamically change based on conversations between partners. It enables a partner to gain a better understanding of the pace and language of a conversation than they previously had (See Figure 3).

My Bot Friends

This messaging app gives you the ability to group message "bot friends," each designed to provide you with a completely different perspective on your relationship (See Figure 4).

Unreasonable IoT System

This IoT system processes voice within an environment and determines if a statement is reasonable or unreasonable (See Figure 5).

Bedtime Future Time

This voice user interface works with a couple to create a story about their future together before they fall asleep (See Figure 6).

Gracefully Built Arguments

This game is designed for couples. Partners build an argument together on a specified topic (e.g., the dishes, in-laws) that is deemed sound by an agent (See Figure 7).

Sentiment Windows

This window system detects the language used and movement in a house, judges the emotional climate of the house, and allows more or less light into the house based on that evaluation (See Figure 8).

Parent Role Playing

These conversation prompts are delivered from an agent to people, encouraging them to improvise a conversation their parents might have had about a topic. Through the activity, partners may learn more about why their partner communicates the way they do (See Figure 9).

Smart Table

This table visualizes the real-time progression of a conversation and encourages reflection afterwards (See Figure 10).

Memory Book

This book collects qualitative descriptions of a couple's time together. The cover of the book dynamically changes based on its contents (See Figure 11).

Family Movie Toy Set

This toy set enables children to shoot scenes suggested by an agent (e.g., when your parents are in a rush, when your parents talk about what they should spend their money on) based on their life at home. After filming, families can watch the films together and parents can see what their children notice about their relationship (See Figure 12).

Parental Advice Wedding Gift

This collection of advice and stories from parents provides information about their relationship. An agent determines the most pertinent time for a couple to receive a piece of advice or story (See Figure 13).

VR Hometown Tours

This VR tour through a person's hometown enables their partner to see where they came from, where they went to preschool, and where they had their first kiss. Agents suggest locations to visit next (See Figure 14).

Music Conversation System

This car stereo system changes music based on the tone and sentiment of a conversation (See Figure 15).

We Hire Only Couples

This company only hires couples. Spouses will no longer work at different organizations or in various roles. Instead, they will work together, at the same organization in the same position, by using productivity software explicitly designed for couples (See Figure 16).

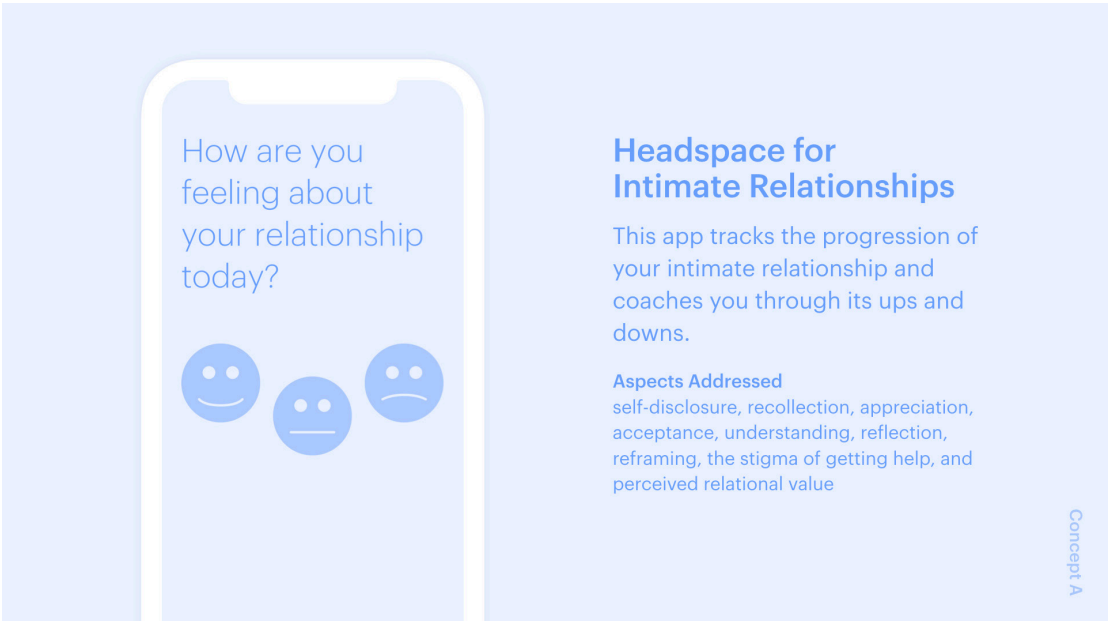
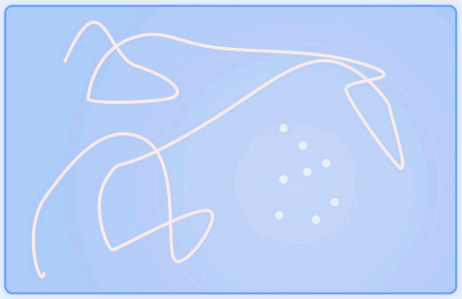


Figure 1
Headspace for Intimate Relationships

Figure 2
Grammarly for Couples



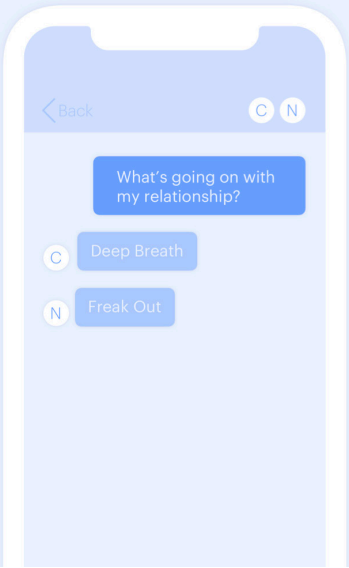
Conversation Art

These pieces of art dynamically change based on conversations between partners. It enables a partner to gain a better understanding of the pace and language of a conversation than they previously had.

Aspects Addressed
understanding, reflection, and the stigma of getting

Concept C

Figure 3
Conversation Art



My Bot Friends

This messaging app gives you the ability to group message "bot friends," each designed to provide you with a completely different perspective on your relationship.

Aspects Addressed
self-disclosure, recollection, appreciation, acceptance, understanding, reflection, reframing, the stigma of getting help, and perceived relational value

Concept D

Figure 4
My Bot Friends

Figure 5
Unreasonable IoT System

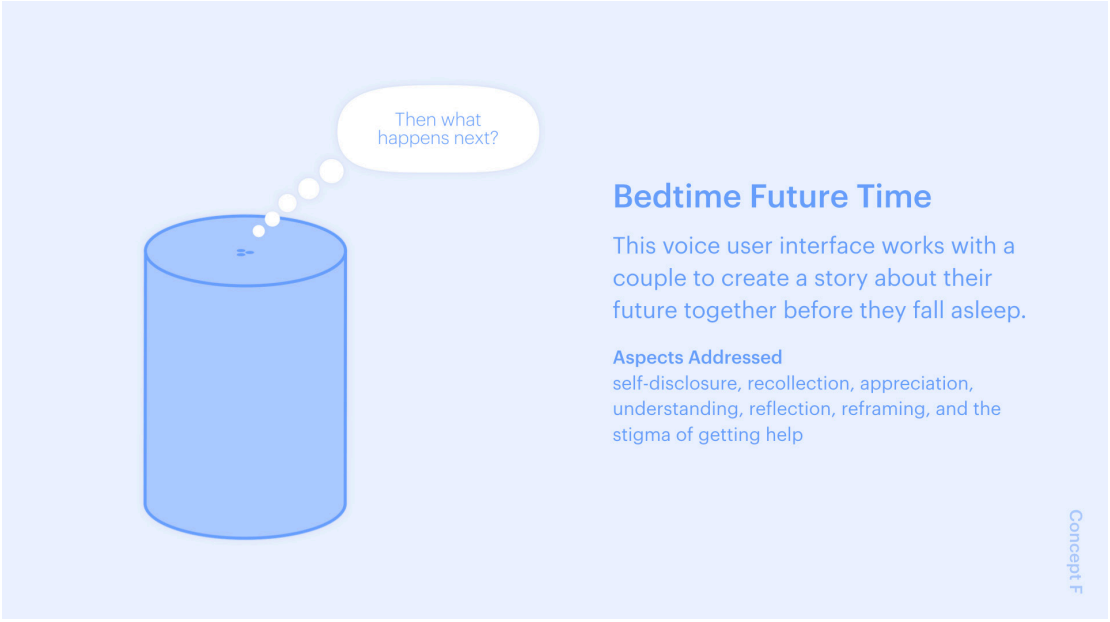


Figure 6
Bedtime Future Time

Figure 7
Gracefully Built Arguments

Figure 8
Sentiment Windows

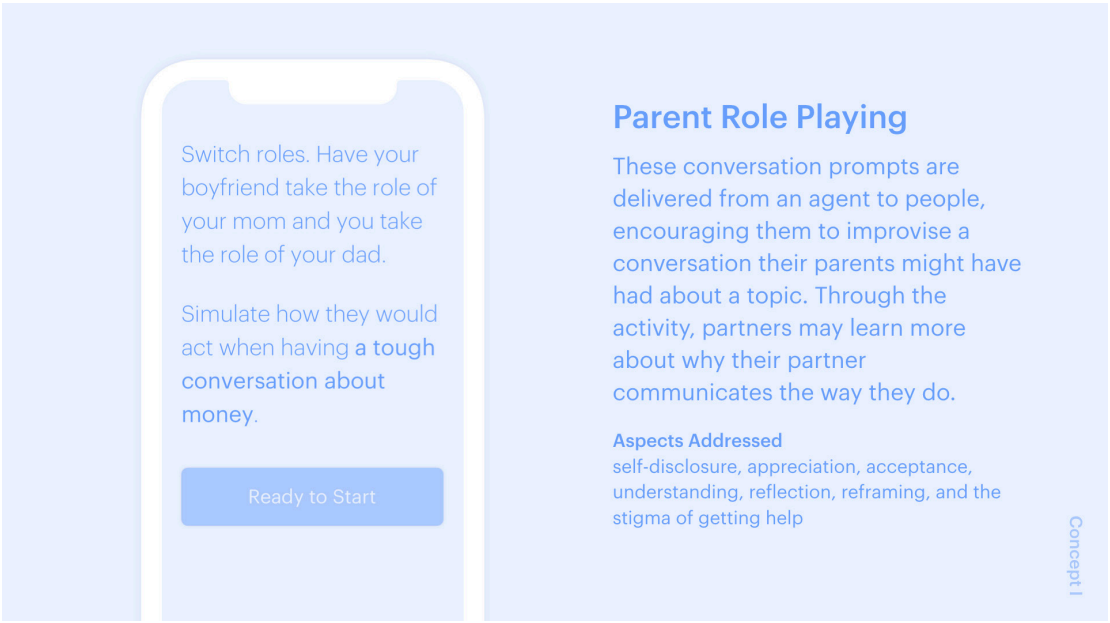


Figure 9
Parent Role Playing

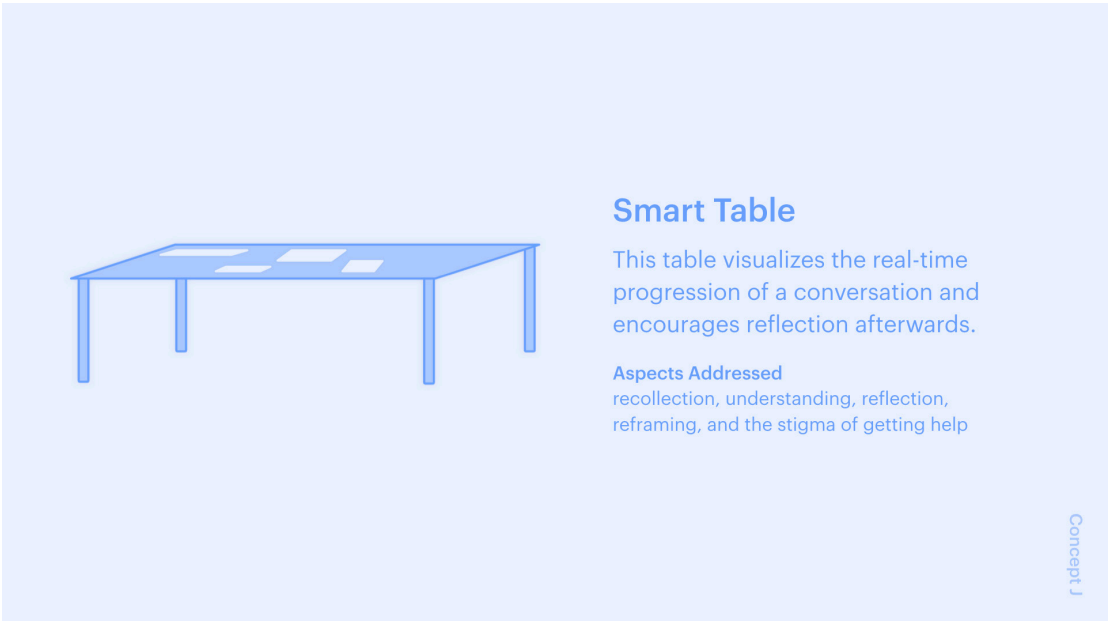
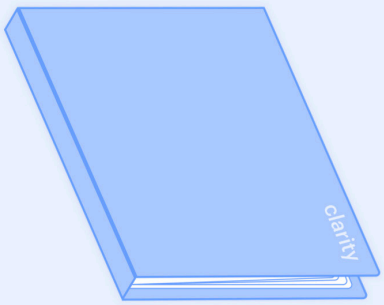


Figure 10
Smart Table



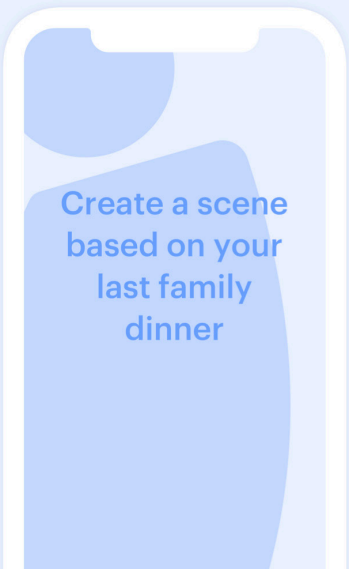
Memory Book

This book collects qualitative descriptions of a couple's time together. The cover of the book dynamically changes based on its contents.

Aspects Addressed
self-disclosure, recollection, appreciation, acceptance, reflection, reframing, the stigma of getting help, and perceived relational value

Concept K

Figure 11
Memory Book



Family Movie Toy Set

This toy set enables children to shoot scenes suggested by an agent (e.g., when your parents are in a rush, when your parents talk about what they should spend their money on) based on their life at home. After filming, families can watch the films together and parents can see what their children notice about their relationship.

Aspects Addressed
recollection, appreciation, understanding, reflection, reframing, and the stigma of getting help

Concept L

Figure 12
Family Movie Toy Set

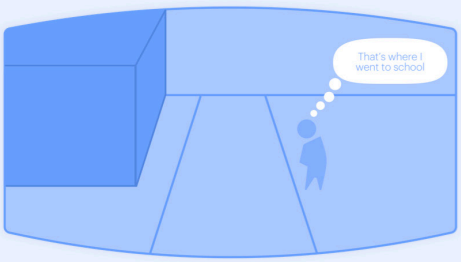
Parental Advice Wedding Gift

This collection of advice and stories from parents provides information about their relationship. An agent determines the most pertinent time for a couple to receive a piece of advice or story.

Aspects Addressed
appreciation, acceptance, understanding, reflection, reframing, and the stigma of getting help

Concept M

Figure 13
Parental Advice Wedding Gift



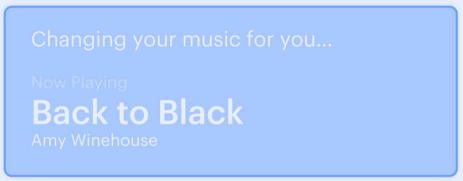
VR Hometown Tours

This VR tour through a person's hometown enables their partner to see where they came from, where they went to preschool, and where they had their first kiss. Agents suggest locations to visit next.

Aspects Addressed
self-disclosure, appreciation, acceptance, understanding, reflection, reframing, and the stigma of getting help

Concept N

Figure 14
VR Hometown Tours



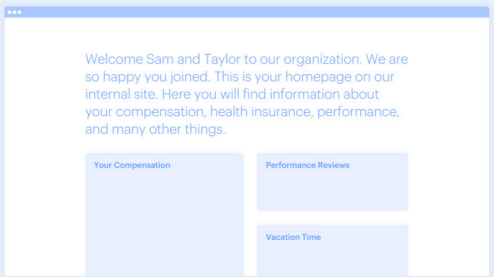
Music Conversation System

This car stereo system changes music based on the tone and sentiment of a conversation.

Aspects Addressed
understanding, reflection, reframing, and the stigma of getting help

Concept O

Figure 15
Music Conversation System



We Hire Only Couples

This company only hires couples. Spouses will no longer work at different organizations or in various roles. Instead, they will work together, at the same organization in the same position, by using productivity software explicitly designed for couples.

Aspects Addressed
self-disclosure, recollection, appreciation, acceptance, understanding, reflection, and reframing

Concept P

Figure 16
We Hire Only Couples

Research Through Prototypes

A large portion of the generative phase was dedicated to conducting investigations through prototypes. It specifically includes the prototyping of artificial agents designed to enhance an intimate partners' capacity for expression and understanding and the evaluation of those prototypes.

Selecting Concepts to Prototype

To determine a set of concepts to prototype, I reviewed and evaluated each concept based on a set of criteria.

A concept needed to address a range of the how might I... statements

Each of the sixteen concepts was designed to address a range of the outer level how might I... statements (i.e., How might I provide a place of reflection for partners and couples? How might I enable a greater understanding of a partner's view?). I selected concepts that address a range of these outer level statements (i.e., no two concepts would be designed to address the same concepts) to ensure that all statements were addressed by at least one concept.

A concept needed to address a range of components of an intimate relationship

I selected concepts that addressed more than one component of an intimate relationship (i.e., A concept should not only address trust within a relationship, but also address one of the other five components) to create a more holistic experience.

A concept needed to intervene at different points of a relationship and its conversations

In order to have a strong impact on partners, no two interfaces should address the same type of couple or intervene at the same point of an intimate relationship. For instance, no two interfaces should be specifically designed for a relationship made up of two young urban professionals or designed for communicating through a messaging client.

I derived a set of five distinct artificial agents designed to support a diversity of contexts and couples. Each agent was designed to enable a partner to better understand themselves, their partner, and their relationship. I believe a partner could then use the information they gain to mature as both an individual and intimate partner (i.e., building the defining qualities of an intimate relationship).

Design of Prototypes

For each concept I created an interactive website or concept video, which simulates a potential situation a couple could find themselves in and highlights how an intervention could aid that situation. My intentions were to create moments where the positives and negatives of an artificial agent become visible and provide users with a way to view conversations, within an intimate relationship and between humans and artificial agents, from a new lens.

I designed the website and videos with the intent of revealing an artificial agent through a larger context that an individual could relate. I did not want to select contexts that individuals could not envision themselves in. For instance I did not want to create a video focused on a couple communicating via email but instead a couple communicating via text, since the majority of couples communicate through text rather than email.

Study Protocol

To evaluate each concept, I ran both online surveys through Mechanical Turk and in-person interviews. The surveys and interviews were used to understand if:

- the concept was effectively addressing the outer level statements and dimensions of an intimate relationship that they were designed to do
- the concept could be effectively integrated into an intimate relationship

I also used these insights to understand how each concept could be improved.

I chose Mechanical Turk specifically because it allowed me to affordably reach an audience I would not have access to otherwise. For each concept, I surveyed at least twenty individuals from the U.S.

In-person interviews were designed to help gather details that were not possible through a survey. At least three individuals were interviewed for each concept, with the majority of them being graduate-level design students.

Evaluation of Concepts

Both of the surveys and interviews made use of semantic differentials. By using semantic differentials as a rating scale, I was able to evaluate each concept based on a number of measures, including how useless or valuable, and irresponsible or sensible a user found each concept and agent to be (See Figure 17). The semantic differentials also served as a starting point for an in-depth conversation or survey question.

Unfavorable Directions

For each scenario, I also created a number of storyboards depicting potentially unfavorable directions of each of these concepts. I deemed pathways unfavorable if I believed they would not effectively address the components and dimensions of an intimate relationship that I intended.

I designed each storyboard to help me consider why a direction could occur and how problems could be avoided. These storyboards were also used as tools to understand what was gained and lost through an interaction with that designed experience.

Figure 17 *(following)*
Sample of Semantic Differential Questions

This concept is:

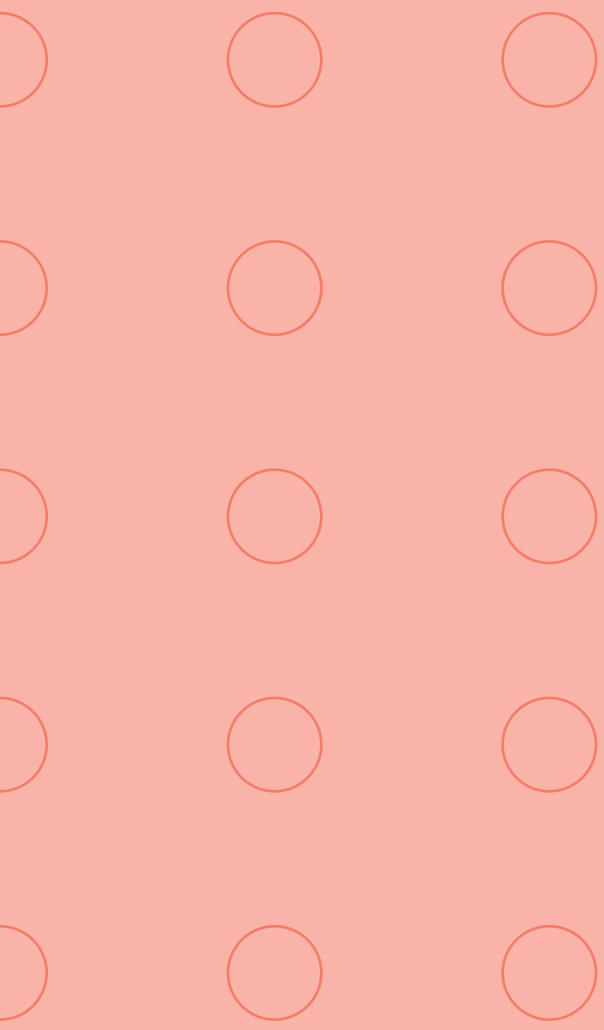
Useless

Displeasing

Discouraging

Overbearing

Irresponsible



Valuable

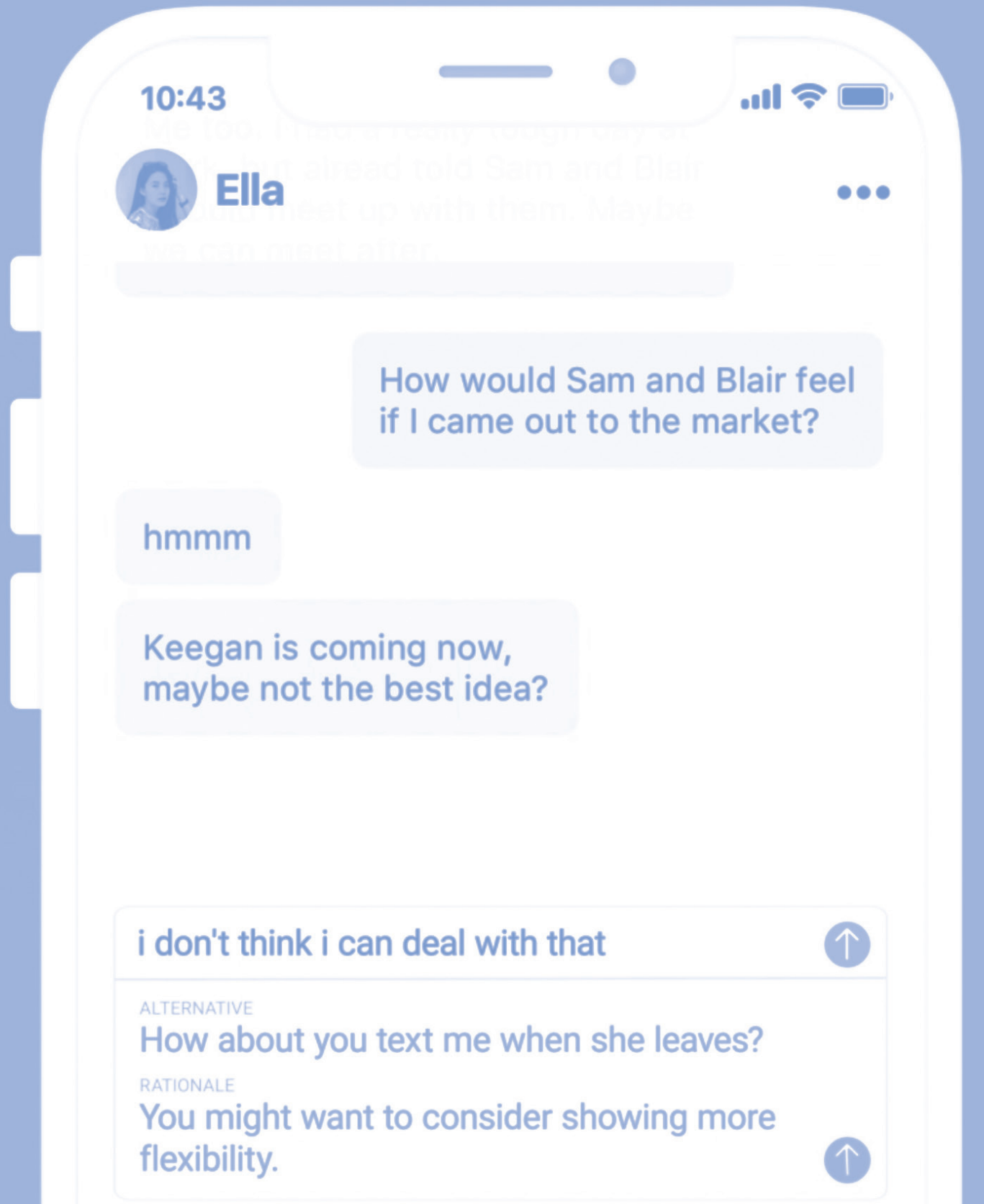
Appealing

Empowering

Deferential

Sensible

Intimately


10:43
Ella
How would Sam and Blair feel if I came out to the market?
hmmm
Keegan is coming now, maybe not the best idea?
i don't think i can deal with that
ALTERNATIVE
How about you text me when she leaves?
RATIONALE
You might want to consider showing more flexibility.

The first concept I designed was Intimately, an AI powered writing assistant intended to enhance one's capacity to express themselves to their intimate partner. Intimately was designed to analyze messages based on effective communication practices and sometimes suggest an alternative. The concept was inspired by Grammarly, a popular online writing assistant designed to make an individual's "messages, documents, and social media posts clear, mistake-free, and impactful" (Grammarly, n.d.).

Intimately was designed as a standalone messaging app for communications between intimate partners. Similar to Facebook Messenger and other messaging platforms, a user would be able to communicate with a partner who has also downloaded Intimately, or with a partner sans Intimately through SMS messages.

Design Approach

While bringing form to Intimately, numerous aspects of the interaction were designed to ensure consistency throughout the experience.

Type of Language Intimately Employs

Intimately provides an intimate partner with alternatives and rationale that address both functional and dysfunctional communication patterns of intimate partners. This way a partner gains a more comprehensive understanding (i.e., both the positive and negative) of the language they employ.

The Need For Rationale Explaining an Alternative

If Intimately finds an issue with a message, the agent provides a sentence or two to explain those issues and the reasons why the agent-developed alternative message could enable greater expression and understanding within that conversation (See Figure 18). I believe this would help create a common understanding between the partner and the agent.

The Look and Feel of the App

I made the decision for Intimately to look and feel like modern messaging platforms so that users would focus on the intelligence integrated within Intimately and not the UI of the app. This ideally enables Intimately to seamlessly integrate into a user's life.

The Look and Feel of Micro Interactions

I paid special attention to the moments where a user composes a message and Intimately evaluates that message against functional and dysfunctional communication patterns, so that those moments convey a sense of intelligence. I also placed focus on other micro interactions to replicate the look and feel of modern messaging platforms (See Figure 19). Both actions were taken to help communicate the boundaries and capabilities of Intimately.

Delivery of Study

To test this concept, I created a website with an interactive choose your own adventure demo that enabled an individual to simulate a conversation with Intimately. This implementation was inspired by *Black Mirror's* 2018 interactive film, "Bandersnatch", and *Choose Your Own Adventure* gamebooks.

To create the demo, I designed eight different paths a user can take. Approximately every 30 seconds, a user is given the opportunity to decide between two messages—one the fictional user has composed, and the other Intimately has suggested (See Figure 20). Once the user chooses the message they would like to send, a new video begins playing (i.e., I used JavaScript to simulate this experience).

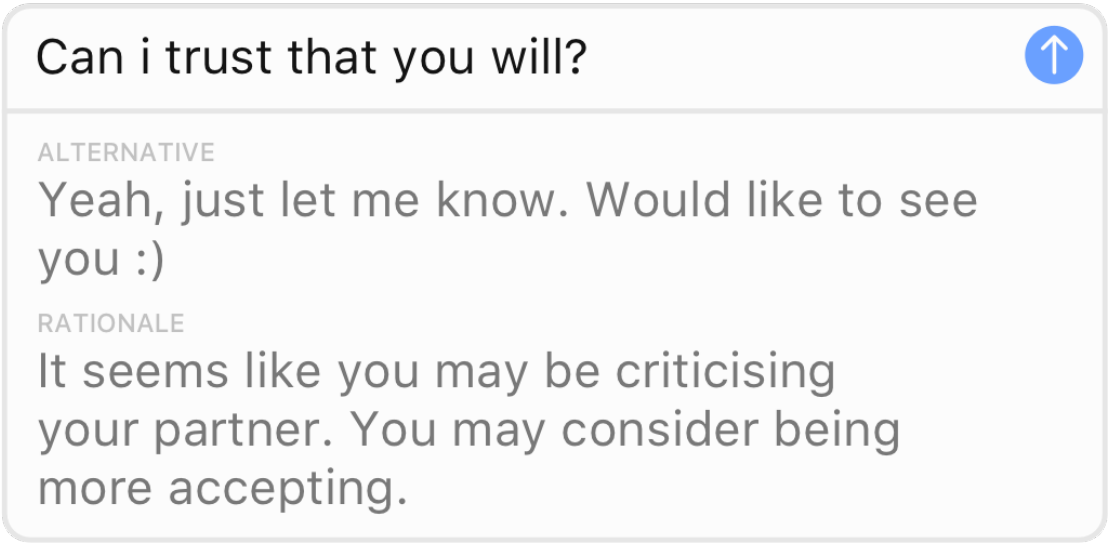


Figure 18
Intimately providing rationale for an alternative

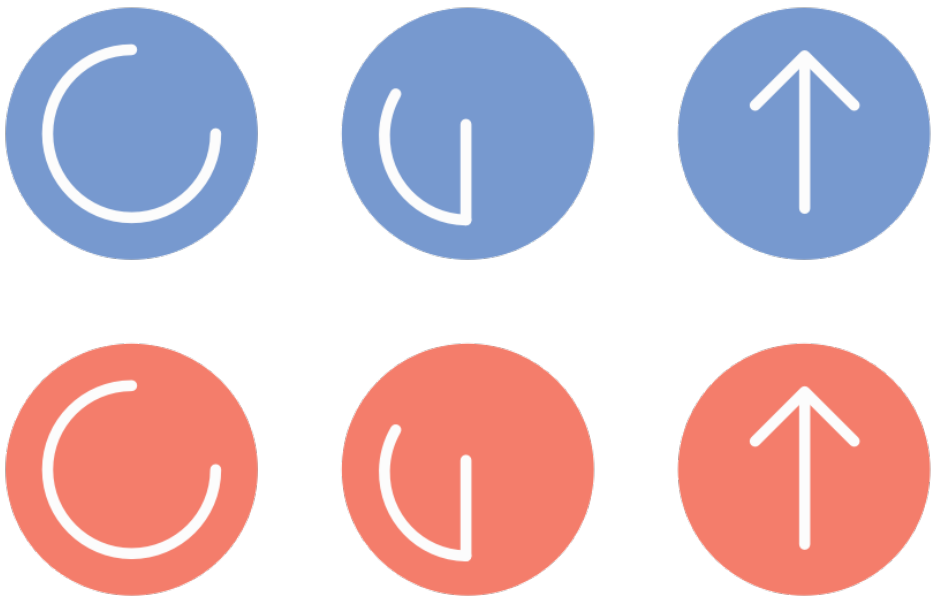


Figure 19
Send button micro-interaction

Study Outcomes

User sentiment from both Mechanical Turk and user interviews was somewhat divided. While the majority of participants viewed Intimately as valuable, appealing, and empowering, others say it is inauthentic and judgmental. One user described it as a tool that could "help you think before you send something," while another described it as a tool to "see others viewpoints." At the other end of the spectrum, a user felt it "would prevent you from writing from your heart" or "could sanction a really poor thought." Other insights from these interviews include:

Intimately could evoke a confirmation bias if a couple is given the opportunity to select specific measures for detection

If the tool provides a user with enormous power in personalizing Intimately, a situation may arise where Intimately does not enhance the person's ability for expression and understanding, but instead confirms the patterns they already find themselves in when expressing themselves to their partner. This should be avoided so that users of Intimately enhance, instead of preserve, their capacity for expression.

Intimately could confront challenges affecting behavior change

For Intimately to affect behavior change, it should vary the delivery of the alternatives and rationale it provides. This approach may prevent users from finding the support stale, while also engaging with the tool in distinct ways that might be effective for that specific user. Providing a place for a user to reflect on the patterns within their communications may also play a significant role in affecting behavior change.

Concept Synthesis

Combining some aspects of the popular writing assistant tool, Grammarly, with effective communication practices for intimate couples, Intimately was able to explore an individual's comfort with an artificial agent's involvement, while also looking at the form in which those practices can be shared. The following is a list of principles gathered from Intimately's testing.

Intimately should support a diversity of conversations and contexts

Intimately should not limit itself to conversations dealing with conflict and can find purpose in other types of conversations. It should also support young couples, older couples, couples who have just begun dating, and couples who have been married for years. As a result, users may find Intimately broadly encompassing (i.e., not just focused on one certain type of conversation or just pointing out the negatives).

Intimately should allow for multiple forms of adjustment

Intimately should allow a user to reflect on a conversation and adjust the parameters and patterns it is seeking in a message. This way users are able to personalize the assistant based on the aspects of their communications that they want to study deeply, while also retaining their unique personality.

Intimately should provide a user the opportunity to dismiss a detected indiscretion

If a user finds that Intimately has been triggered based on a message the user sees no problem with, the user should be provided with an opportunity to note why they find no issue with that message. By doing this, users will be able to effectively communicate with Intimately, enabling them to achieve a higher degree of conversational symbiosis.

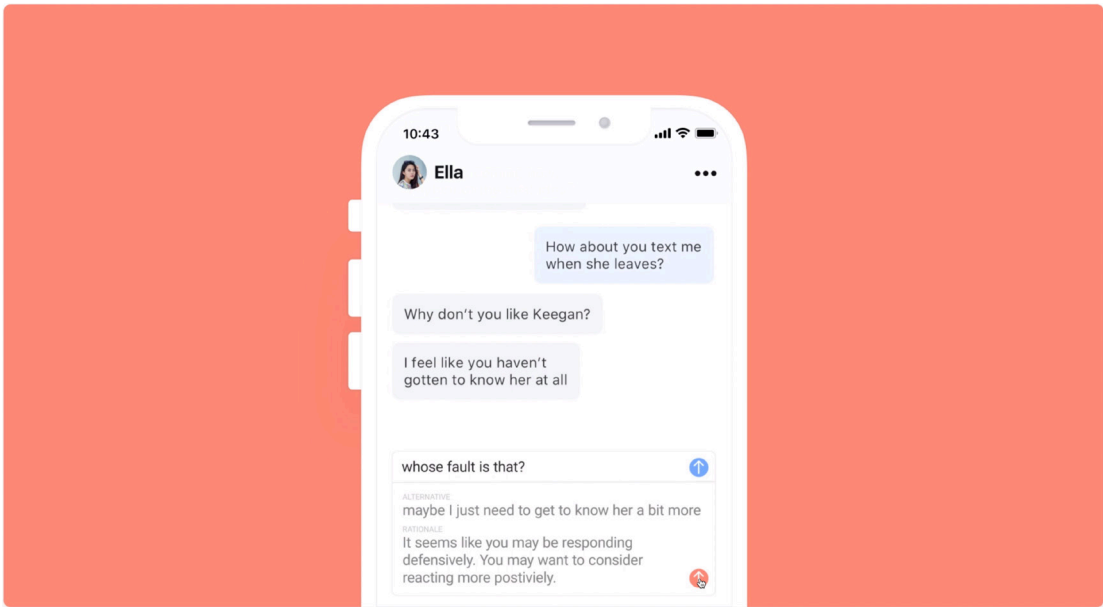


Figure 20
Viewers are given the opportunity to decide between two messages

Intimately should afford numerous opportunities for reflection

A user should be given numerous opportunities to reflect on past conversations and, more specifically, the messages that have been influenced in some form by Intimately. This will give them the opportunity to analyze the patterns within their communications and the ways they have enhanced their capacity for expression and understanding.

Intimately should evolve its voice based on a couple and their communications

The language and strategies one individual or couple finds helpful may not be useful to every couple. As a result, Intimately should continuously work to determine the language and strategies that an individual or couple finds productive at specific times and places in their relationship so that individual or couples capacity for expression is continuously grown.

Unfavorable Directions

Storyboards depicting potentially unfavorable directions involving Intimately focused on the following developments.

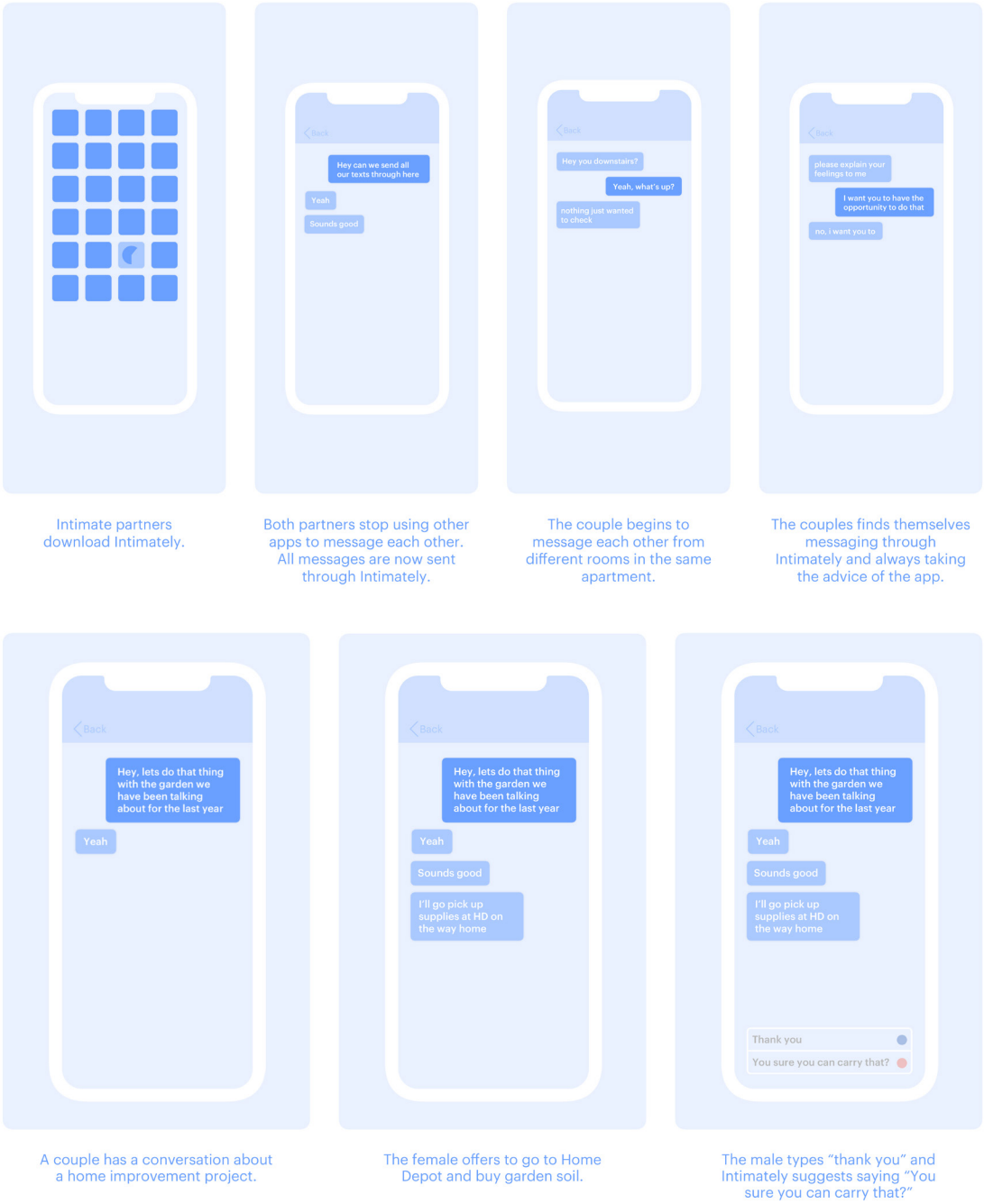
- A couple whose exchanges are entirely mediated through Intimately (See Figure 21).
- An intimate partner that does not tell their partner they are using Intimately.
- Intimately being biased towards certain gender norms (See Figure 22).

Considerations for the Future

Two themes that arose from these storyboards were that of a lack of visibility into the system and the potential for bias in the system.

Bringing visibility into the system, whether through forms of reflection or small UI elements that let the receiver of a message know that their partner was using Intimately, is a topic that deserves consideration. If not, Intimately could enhance an intimate partner's capacity for expression, but also play a role in the deterioration of trust and commitment in that partner's relationship.

It is also important to consider that a person could extend a relationship longer than warranted. To avoid such instances, thought should be put into developing moments of reflection so that a person understands how their use of Intimately has affected their relationship. It will also be necessary for the models powering this app to be trained on data that is representative of all forms of communication styles.



Figures 21 and 22
A couple whose exchanges are entirely mediated through Intimately (above) and Intimately being biased towards certain gender norms (below) storyboards

Curb

The second concept I designed is Curb, a detector for indiscretions between couples who can't seem to communicate, who are just kind of mean, or just shouldn't be together.

Curb was designed to have an almost intrusive quality and is based off of popular smart speakers. Unlike Intimately, Curb is not designed to enhance a partner's capacity for expression, but enhance a partner's capacity for understanding. It does so by specifically intervening in a conversation before it reaches a point where that conversation no longer allows for growth in a relationship. The detector is triggered when it identifies language that it deems dysfunctional and interjects itself into a conversation by asking a partner if that is what they meant to say.

Design Approach

Different aspects of Curb are designed to ensure that the detector integrates itself into an intimate relationship effectively.

The Visual Feedback Displayed

Special attention was paid to the visual feedback of Curb, specifically the aspect of feedback resembling a heartbeat—slow and regular when listening, and fast when an indiscretion is detected. The color of the LED lights also change when an indiscretion is detected to depict an activated state (See Figure 24). In addition, I decided to scatter the lights throughout the detector to bring life to the piece in its entirety rather than just a small part of the detector (i.e., the four lights in the center of Google Home; the ring around an Alexa).

The Look and Feel of the Object

I made an explicit decision to give Curb a form that was very different from what a user would expect from a smart speaker today, in order to combat availability bias. Curb was designed to have a more natural shape, resembling a kidney. Instead of filtering blood, Curb filters language. By making references to a natural form, the prototype more easily integrates itself into a couple's home environment (See Figure 23).

The Language It Would Employ

I avoided very forceful language, in order to create a collaborative environment that put the onus on the individual to participate in some form of self-introspection. As a result I designed the detector to ask the partner, Is that what you meant to say? This conversational approach opens a line of dialog which conveys a degree of uncertainty but also serves as a prompt for reflection.

Delivery of Study

To test the concept, I created a video. The video introduces the detector and portrays a sequence of four different couples encountering some form of a breakdown in a conversation. After every breakdown, Curb interjects by asking the partner, who was the instigator of the breakdown, if they meant to say what they just said (See Figure 25).

The prototype intentionally includes a variety of voices to represent the diversity of intimate partners and a range of different shots to depict the potential versatility of the detector (i.e., the detector could be place on a wall, ceiling, or table surface in a family room, kitchen, or bedroom).

Figure 23
Curb on a wall

Figure 24
When triggered, LED lights beat faster and change colors

Study Outcomes

Curb's user sentiment was less favorable than that of Intimately, but still garnered more positivity than negativity. While some participants saw it as annoying, stupid, and overbearing, others saw it as neutral and empowering. Those who saw it in a negative light said using Intimately could represent "admitting that one's relationship is bad." Whereas those that viewed it in a positive light believed it "could save a marriage" or "be helpful to people having a hard time talking to their spouse." Other insights gathered from research participants include:

Curb could evoke a confirmation bias if a couple is given the opportunity to select specific measures for detection

Similar to Intimately, if Curb provides a user with too much power in personalizing the detector, opportunities for enhancing an intimate partner's capacity for expression and understanding could be missed.

Curb could confront challenges affecting behavior change

Similar to Intimately, Curb may struggle to effect behavior change on a consistent basis if the same communication breakdown activates Curb time and time again. To enhance a partner's capacity for expression, it may be beneficial to explore different forms of support Curb can provide.

Study Synthesis

Curb's design was inspired by smart speakers and designed to explore the different ways to convey information to intimate partners. I sought to gain a better understanding of the ways such an intervention could integrate into the environments that couples inhabit. The following is a collection of principles I gathered while testing Curb.

Curb should support a diversity of conversations and contexts

Like Intimately, Curb should deal with conversations beyond those of conflict. For instance, Curb could celebrate a conversation that builds understanding between a couple, instead of only bringing attention to breakdowns. In turn, Curb could increase people's appreciation and perceived relational value for themselves.

Curb should allow for multiple forms of adjustment

Curb, like Intimately, should allow room for a user to adjust the parameters and patterns the detector is seeking, resulting in an open channel back and forth between the couple and Curb; essential for conversation symbiosis.

Curb should provide a user the opportunity to dismiss a detected indiscretion

Similar to Intimately, Curb should provide an environment for people to reflect and evaluate the specific exchanges that trigger Curb. As a result, a couple could avoid situations where Curb is activated time and time again in response to exchanges that the couple has deemed as positive.

Curb should afford numerous opportunities for reflection

A user should be given a variety of opportunities to reflect on the moments Curb is triggered, ultimately giving users time to acknowledge and consider instances of breakdowns and wins in their communication with their partner.

Figure 25 *(opposite)*
Sample dialog from Curb's concept video

Partner A
Why did you do that?

Partner B
I didn’t think it would be a big deal.

Partner A
You actually believe that?

Curb
Jordan is that what you meant to say?

Curb should evolve its voice based on a couple and their communication

The specific language and delivery used by Curb could change based on the couple and the situation in which they find themselves. It is naive to think that every couple or even the majority of couples can be successfully reached through the use of the same language and delivery of that language. Thus, a diversity of language is needed to reach a large portion of couples.

Unfavorable Directions

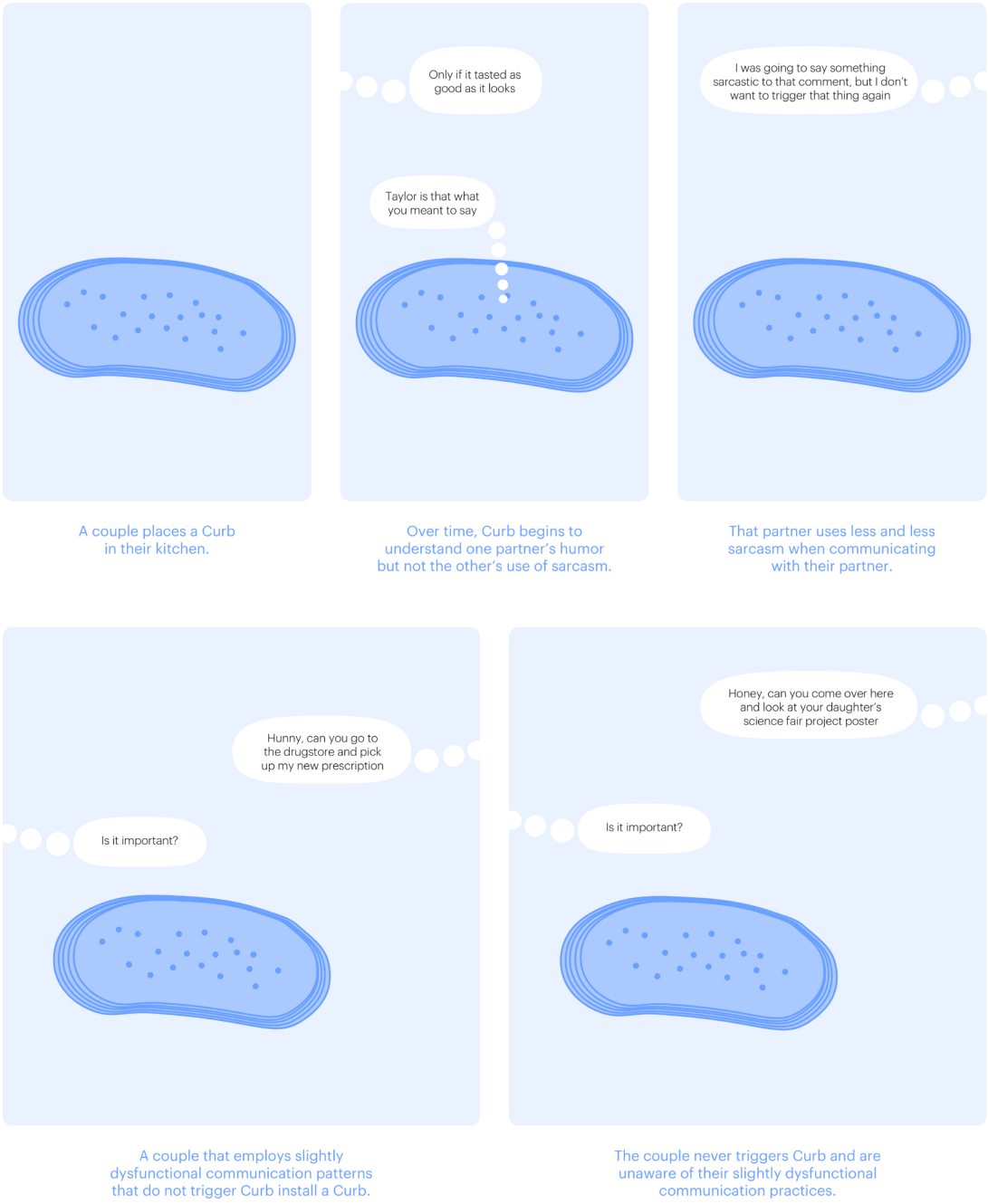
Storyboards based on Curb that depict potentially unfavorable directions focused on the following lines of questions.

- Curb being biased towards certain forms of expression (See Figure 26).
- Curb normalizing dysfunctional behavior over time (See Figure 27).

Considerations for the Future

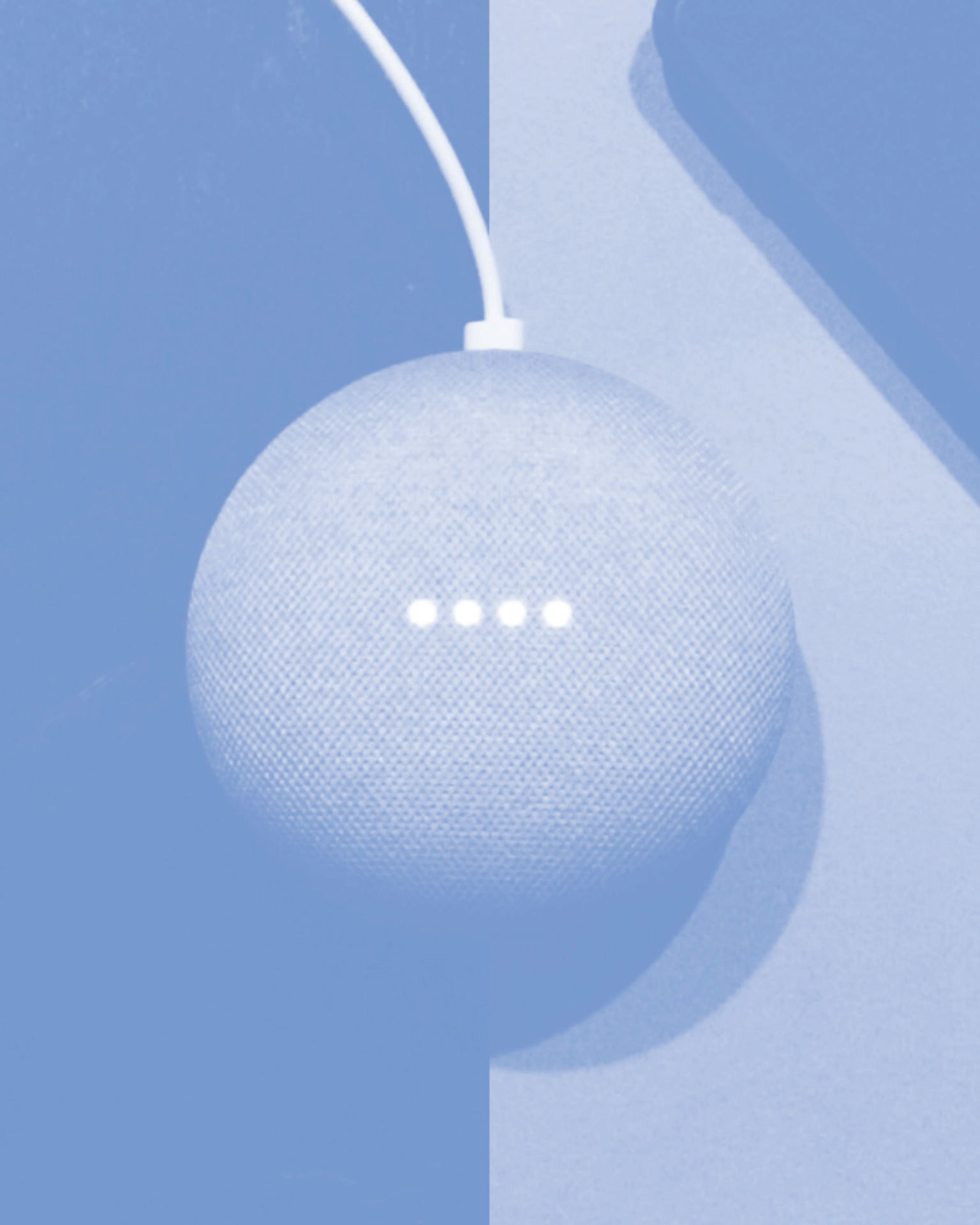
Both of these storyboards depict the need for improved visibility and the potential for built-in bias. Nonetheless, greater investigation into how users can become aware of what triggers Curb and the origin of the data powering the determinations is necessary (i.e., should Curb be a closed system that only considers the communication patterns of that specific couple).

It is also essential to consider a situation where a couple sees Curb as a definitive source (i.e., what is appropriate and not appropriate?). In such a situation, should uncertainty be outwardly depicted by the system for a couple not to consider Curb as an authoritative source?



Figures 26 and 27
Curb being biased towards certain forms of expression (above) and Curb normalizing dysfunctional behavior over time (below) storyboards

Bedtime Visions



I designed Bedtime Visions as a place for a person and their partner to uncover and develop visions for their future together. Bedtime Visions is designed to facilitate conversations a couple may not normally have to help them foster understanding, reveal new information, or simply remind their partner about something.

I focused my attention on the specific setting of the interaction. By situating the experience at bedtime, I intended to create an environment similar to that when bedtime stories were created by parents for their children, enabling development of fantastical or realistic narratives.

Design Approach

Multiple features of Bedtime Visions were designed so that couples could uncover and develop visions of their future together.

The Context of the Experience

Designed specifically for couples at bedtime, Bedtime Visions is intended to create an environment in which partners are able to lower their walls and forget their inhibitions, allowing for a conversation they would not typically have.

The Type of Activity It Would Facilitate

To take advantage of the environment Bedtime Visions is set in and facilitate a conversation that a couple would not typically have, I chose the focal activity to be couples having conversations about their future together.

The Language It Would Employ

In order to ensure that Bedtime Visions could be prototyped, I used Dialogflow, Google's tool to "build natural and rich conversational experiences." With Dialogflow, I was able to design Bedtime Visions, while considering the natural language processing capabilities of Dialogflow.

Delivery of Study

To test Bedtime Visions, I created a video of two couples—one old, one young—interacting with Bedtime Visions. Both couples in the video participate in the same activity by creating a vision of their future together in ten years (See Figure 30). While each scenario isn't exactly the same, a user can recognize similar desires both couples have.

The video screen is split so that the younger couple occupies half the screen and the older couple is shown in the segment (See Figure 28). Audio was also split between the left and right channels so that the viewer hears one couple in one ear and the other couple in the other when wearing headphones (See Figure 29). At the center of the video is a Google Home, the device Bedtime Visions lives within.

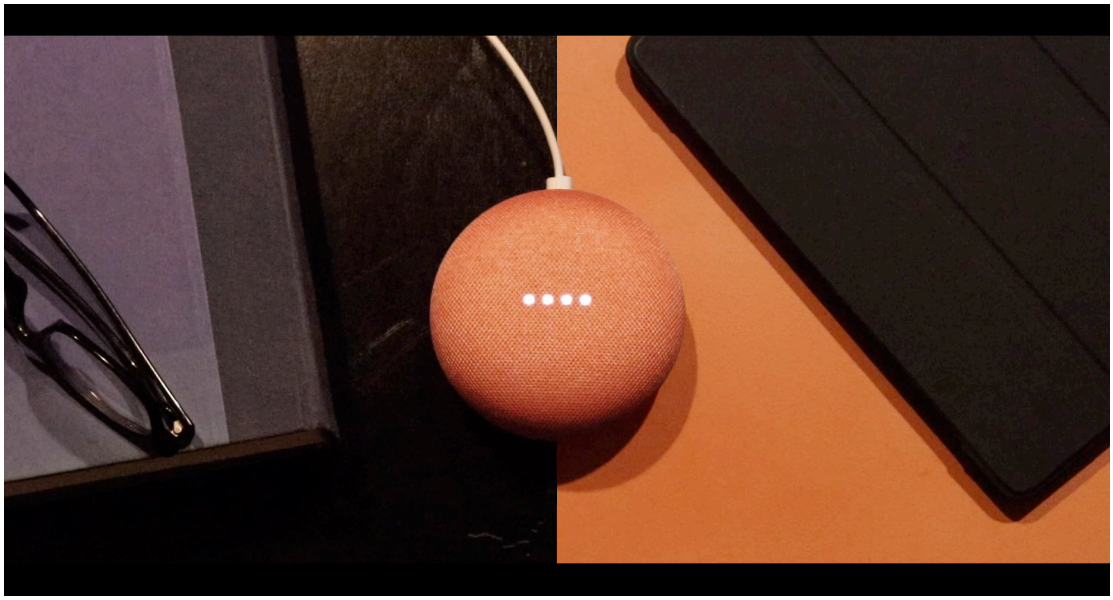


Figure 28
Video screen split in half (older couple on the left, younger couple on the right)

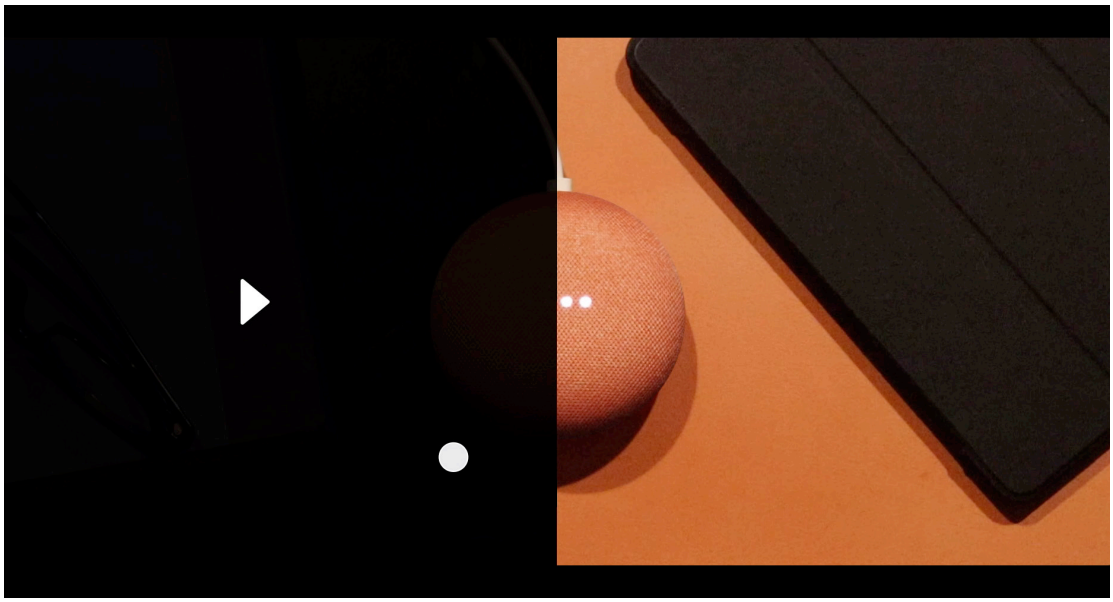


Figure 29
Video focuses on the conversation of one couple at a time (audio isolated to to the right or left channel based on the side of the screen that couple occupies)

Study Outcomes

Bedtime Visions user sentiment was more positive than that experienced by Intimately and Curb. While one participant questioned how it was different than regular pillow talk, most participants saw it as a way to "set future goals", "strengthen... [a couple's] connection," "have fun together," and "empower... [a couple and their] future." One participant found it to be "weird" as they were "not used to robots asking these types of questions." Other insights from participants include:

Bedtime Visions could support couples when confronting difficult topics

When Bedtime Visions encounters a difficult topic for two partners, Bedtime Visions could draw from a variety of frameworks that deal with such topics, thus helping the couple to work through this discussion.

Bedtime Visions could be a part of a larger platform

Bedtime Visions could be a part of a large ecosystem of conversations that supports a couple in a variety of settings to effectively integrate into the everyday life of a couple. For instance, Bedtime Visions could leverage the specific conversations couples have in a kitchen or during a car ride.

Bedtime Visions could encourage conversations beyond visioning exercises

Like the other two concepts, Bedtime Visions could confront numerous challenges affecting behavior change if it was limited to just visioning activities. If it also involved reflective or appreciation activities, Bedtime Visions would have a higher chance of affecting behavior change.

Study Synthesis

Unlike Curb and Intimately, Bedtime Visions helped me create a scenario centered on an artificial agent that was less familiar to users and take a deeper look at the possibilities for a set of humans and an artificial agent to achieve conversational symbiosis. What follows is a set of principles that were derived after testing Bedtime Visions.

Bedtime Visions should facilitate impromptu and dynamic conversations

Bedtime Visions should not be limited to pre-planned conversations about a couple's future. It should also provide the opportunity for couples to have conversations that are unique to a place and time, for it to alter the practices of couples beyond a single interaction.

Bedtime Visions should facilitate specific conversations for particular stages of an intimate relationship

A conversation set ten years in the future may or may not be appropriate for a couple who has been dating for a couple of months. Bedtime Visions should consider the context of a relationship and allow for conversations that fit that context, to effectively share frameworks and concepts with couples.

Bedtime Visions should support and not direct a couple

Bedtime Visions should guide a couple through lines of conversations that it deems as beneficial for that couple. It should not force a couple to have a conversation about a vision of the future that the couple does not find interesting or worthwhile, so that a couple is able to evolve with the agent over time.

Figure 30 *(opposite)*
Sample dialog from Bedtime Visions's concept video

Bedtime Visions

Imagine you both wake up tomorrow. Look at your phones. They say it is 2029. You both run to the bathroom and look about 10 years older. Something happened while you were sleeping. Suppose you do get ready and face that day. What does 2029 look like?

Partner A

We are still living in this house.

Partner B

The grandkids are still sleeping in a room down the hall.

Bedtime Visions should elicit imaginative and unfamiliar visions

Taking advantage of the environments in which Bedtime Visions is situated gives a designer the opportunity to enable conversations that a couple may not typically have within the context of their relationship, supporting greater self-disclosure between partners than what currently exists.

Bedtime Visions should evolve its voice based on a couple and their communications

Like Curb, Bedtime Visions could evolve the language and delivery it employs based on the couple, and the context of their situation, so that it is able to productively communicate in a variety of situations a couple may encounter.

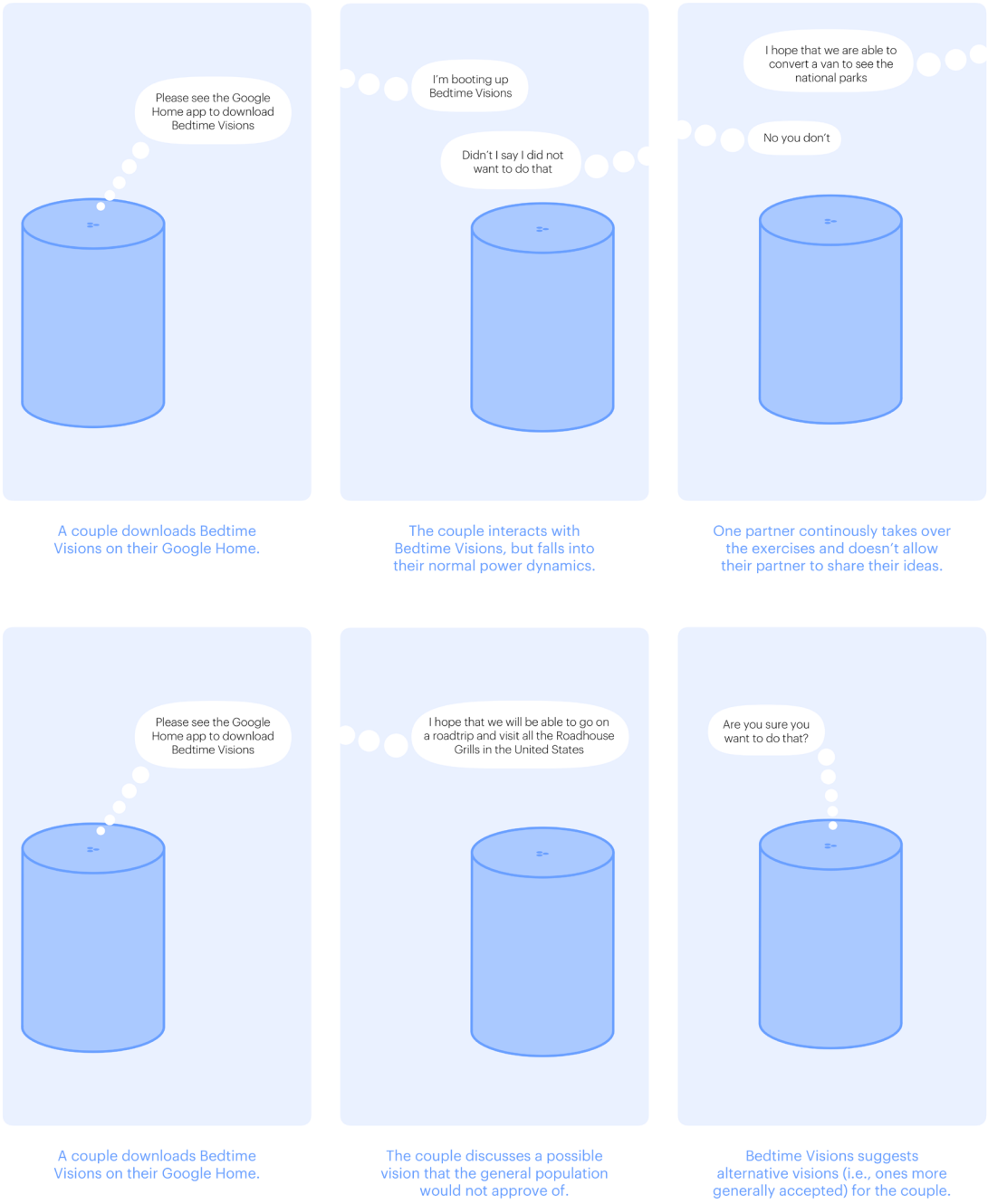
Unfavorable Directions

Storyboards depicting potentially unfavorable directions involving Bedtime Visions focused on the following developments.

- Bedtime Visions failing to create a neutral space (See Figure 31).
- Bedtime Visions being biased towards certain visions of the a couple's future (See Figure 32).
- Bedtime Visions failing to create a successful environment for visioning.

Considerations for the Future

Themes found in these storyboards include the visibility of the agent and the curation of the environment. Further consideration needs to be paid to creating an environment that aligns to a specific couple, enables them to look beyond the dynamics of their everyday life, and provides scaffolding that helps a couple enter a space where they are jointly able to vision their future together. Consideration of Bedtime Visions's models should be taken to ensure that it functions for a diversity of visions and experiences, and that it does not limit itself to those visions that are held by a large portion of the population.



Figures 31 and 32
Bedtime Visions failing to create a neutral space (above) and Bedtime Visions being biased towards certain visions of the a couple's future (below) storyboards

Dinner Time Visualizations

Dinner Time Visualizations is a computational system I designed to better understand the emotions an intimate partner conveys at the dinner table. The system is comprised of two monitors, placed directly behind each partner, that visualizes the facial expressions of the partner sitting across from it.

By situating the experience at the dinner table, I aimed for the visualization to successfully integrate itself into all sorts of different conversations a couple might have. This could be a larger conversation about their future (e.g., considering having another child) or a decision with few consequences (e.g., what movie to watch after dinner).

Design Approach

Different aspects of Dinner Time Visualizations were designed so that an intimate partner could better understand the emotions they convey at the dinner table.

The Visual Language

I carefully developed a visual language that could easily convey a range of emotions understood by its users. The affordances of technology were also taken into account. For instance, I was unable to determine a way to code evolving gradients using p5 and instead focused on graphical elements that would appear and disappear.

The Specific Emotions That Are Triggered

I used Paul Ekman's six basic emotions as the basis for evaluation within Dinner Time Visualizations (See Figure 33). Users were able to discern between the six emotions, which provided ample depth to the experience as a whole.

Feasibility Given Today's Technology

I struggled translating this concept into working code and filming a video that effectively conveyed its capabilities. While I was able to successfully implement the Affectiva API to "detect emotion in real time" (Affectiva) and connect that API to the data visualization and its elements, I was unable to shoot that visualization on a screen using live action. To overcome that challenge I created an animated video that did not rely on an external screen.

Delivery of Study

For Dinner Time Visualizations, I created a working demo and an animated video. The demo was created to show a working implementation of the visualization, while the animated video was used for testing.

The animated film tells the story of a couple having a conversation over dinner (See Figure 34). The script of the film was specifically designed to show the range of emotions the system could communicate, such as anger and happiness. Topics covered in the animated film were chosen based on the findings of the Mechanical Turk study.

Figure 33
Dinner Time Visualization's Emotion Visual Language

Study Outcomes

User sentiment from testing Dinner Time Visualizations was slightly more positive than negative. While some users noted that "you should be able to understand your expressions without visual feedback", others saw it as "empowering" and "cute." I also learned that some users felt that Dinner Time Visualizations could "allow someone to adjust their behavior", but at the same time draw oneself "out of the conversation" and "potentially escalate a situation." Another insight distilled from user's surveys and interviews is that:

Dinner Time Visualizations could scrutinize a conversation from the lens of an individual and couple

Since Dinner Time Visualizations feeds information back to an individual, it could differentiate the emotions that one partner expresses from the general mood of the conversation. This way a user would be able to recognize the effect of their shared emotion on the overall conversation.

Study Synthesis

While Dinner Time Visualizations proved to be challenging to implement, the concept enabled me to explore the different forms that feedback could take, while also investigating potential contexts for an experience within an intimate relationship. The following are principles I gathered when evaluating Dinner Time Visualizations.

Dinner Time Visualizations should employ a visual language that does not distract

The visual language of the current instantiation of Dinner Time Visualizations was hard to decipher and was often distracting. Simplifying the visual language could help a user gain more information from the visualization while also being less distracted.

Dinner Time Visualizations should allow for multiple forms of adjustment

Similar to Intimately and Curb, Dinner Time Visualizations should provide a user the opportunity to understand and change the specific forms of expressions they seek. Users should then be able to achieve a high degree of conversational symbiosis.

Dinner Time Visualizations should bring attention to both unfavorable and favorable behavior

Attention should not only be brought to the those emotions that could be described as negative; Dinner Time Visualizations should also emphasize those moments when couples are taking positive stances or are in complete sync with each other. This has the potential to yield greater appreciation and perceived relational value for oneself.

Dinner Time Visualizations should present directions for its use

Regardless of the visual language employed by Dinner Time Visualizations, users should be provided with a chance to understand what the different elements of the visualization represent to help the user take full advantage of Dinner Time Visualizations.

Dinner Time Visualizations should be well integrated into an environment

Dinner Time Visualizations should not draw an individual into a conversation, instead it should support that conversation and lead that partner to better understand the emotions they convey. Bringing the conversation to life as a large visualization behind one's partner might be seen as distracting, making exploration into different possible forms necessary.

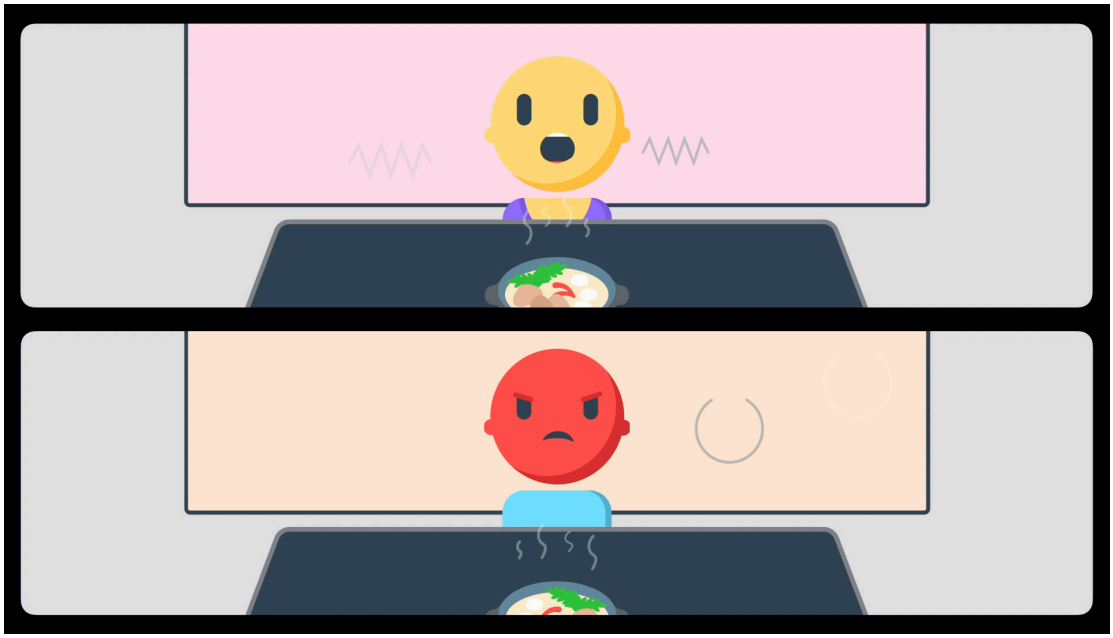


Figure 34
Frame from Dinner Time Visualizations's animated concept video

Dinner Time Visualizations should provide a user the opportunity to question a specific interpretation

Somewhat similar to the other concepts, Dinner Time Visualizations should allow a user to validate when they are expressing a certain emotion. For instance, an individual's facial expressions could convey anger to others when they are not angry. Thus, a user should be able to build a baseline for how they express certain emotions that result in a beneficial experience for both partners.

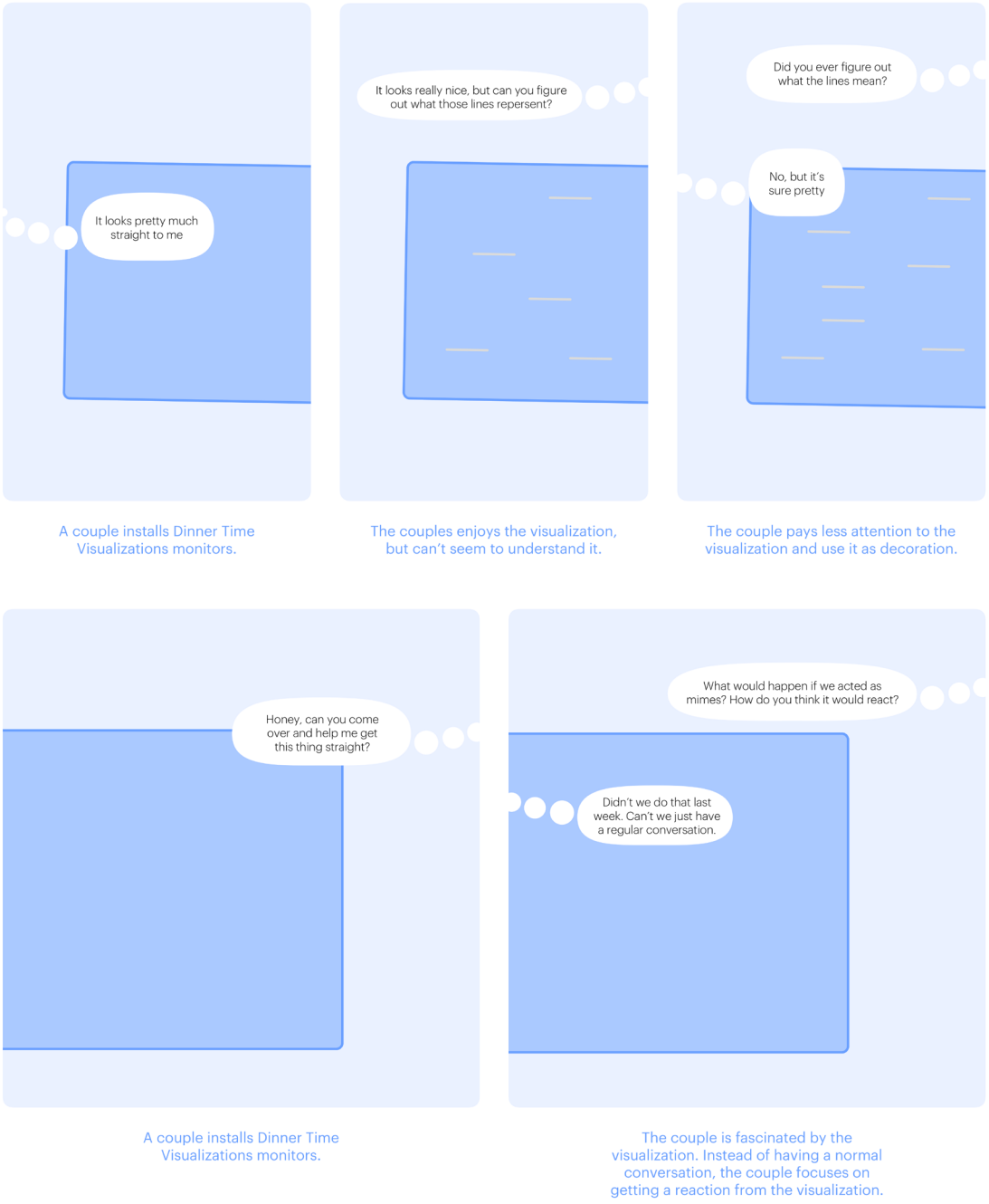
Unfavorable Directions

Storyboards focused on Dinner Time Visualizations and potentially unfavorable directions of that experience concentrated on the following statements.

- A couple that does not understand the Dinner Time Visualizations visual language (See Figure 35).
- A couple paying more attention to the visualization than their own conversation (See Figure 36).
- Dinner Time Visualizations being biased towards certain forms of expression.

Considerations for the Future

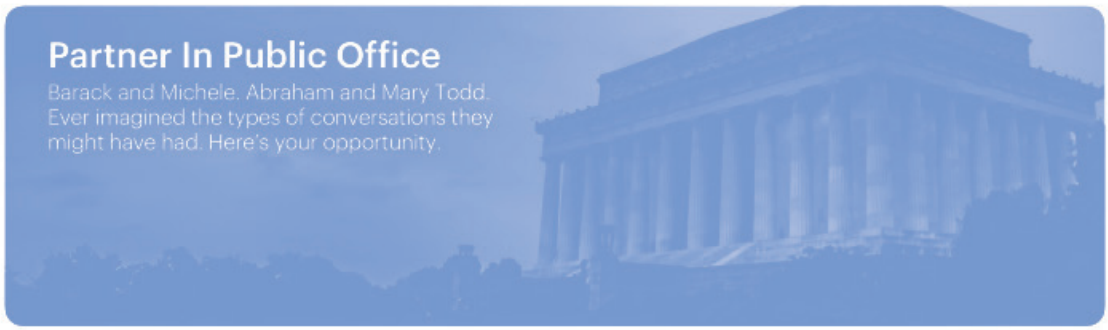
One theme I found throughout these storyboards was that the algorithms behind the visualizations created by the artificial agent lacked visibility—both in terms of the visual language representation and the models they employ. To deal with this issue, the forms used to convey information in Dinner Time Visualizations, the ways in which a user can influence the models, and how the models are informed by various inputs (i.e., my prototype of Dinner Time Visualizations is only informed by facial images, if I continue working on this concept I hope to expand that to more than one form of input) warrants consideration.



Figures 35 and 36
A couple that does not understand the Dinner Time Visualization visual language (above) and a couple paying more attention to the visualization than their own conversation (below) storyboards

Private Conversations

Conversations



First Date

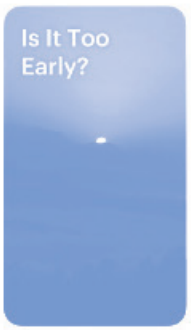
See All

Conversations had on a first date. Careers. Food. Sports. Pets. Friends. Family. Religion?

First Month of Dating

See All

It's getting serious. You are building a foundation for the rest of your relationship. What could go wrong?



Private Conversations is a game for a person and their partner to enact strange hypothetical conversations a couple might have without real-life consequences. The game was designed for people to amuse and enjoy themselves while having a variety of different conversations that are engaging in various ways. The conversations were also designed to engage a variety of partners who are at different points in their relationship.

The specific conversations were designed to help a couple uncover topics that could potentially cause conflict later in their relationship. By simulating a conversation now, a couple may avoid having a damaging or uninformed conversation later in their relationship.

Design Approach

Numerous decisions were made when designing Private Conversations to help an intimate couple build appreciation and understanding for their partner.

The Types of Conversations Available

Efforts were made to vary the types of conversations available on Private Conversations (See Figure 37). While some conversation topics took a serious tone, I made sure that some of the conversations were more playful in nature. I decided to depict a conversation that focuses on in-laws, because it is a topic that numerous couples struggle with. In addition to crafting the conversation to aid meaningful discourse, it also provides a space for comical relief.

The Form of Feedback a Couple Would Receive

Private Conversations is designed to take a similar approach to Intimately, in that the couple's decisions would affect the next stage of a game. Other forms of feedback, including notifications with pieces of advice and strategies, were included in the game to provide frameworks and concepts for an intimate couple that may be unfamiliar with them (See Figure 40).

The Device Couples Would Use to Play the Game

Private Conversations was designed for a couple to work together. Mobile phones are not well suited for this, since the phone limits the amount of detail that can be displayed on the screen. Instead, a tablet provides an alternative that has ample screen space, while also enabling that couple to engage with the game at a variety of locations and points of time.

Delivery of Study

To test Private Conversations, I created a video of a couple playing the game. From a first-person perspective, the video portrays a couple opening the app, selecting a conversation, and then enacting a conversation (See Figures 38 and 39).

The video portrays as life-like of an app experience as possible (i.e., elements were added to replicate a typical iOS experience). I selected in-laws as the topic of the conversation because a significant amount of respondents in the Mechanical Turk study noted conversations about their partner's parents as those that tend to be difficult to conduct.

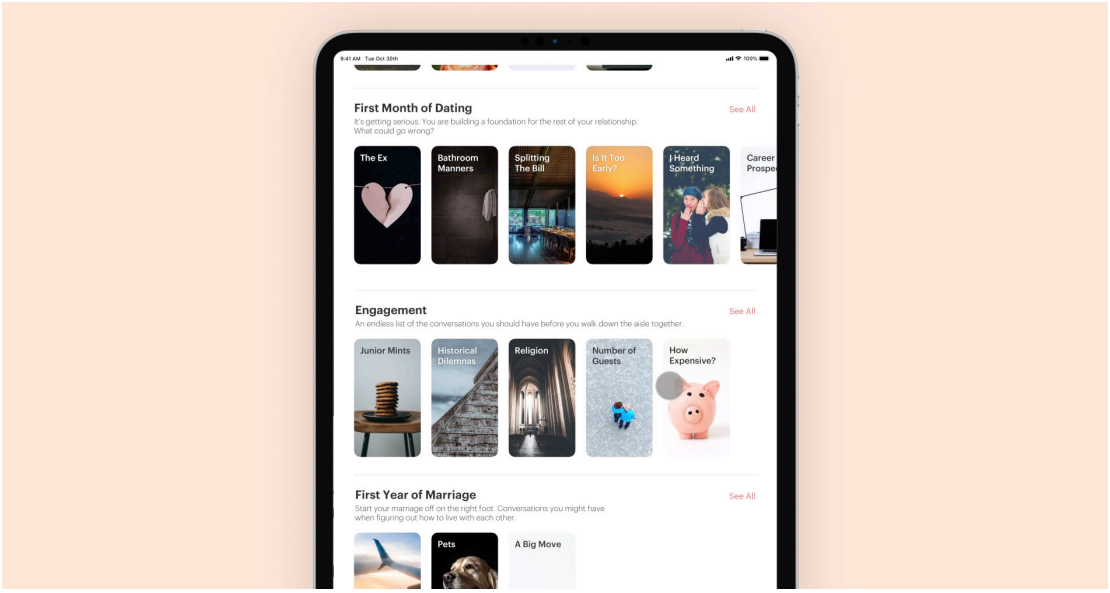


Figure 37
Users have a diversity of conversations to choose from

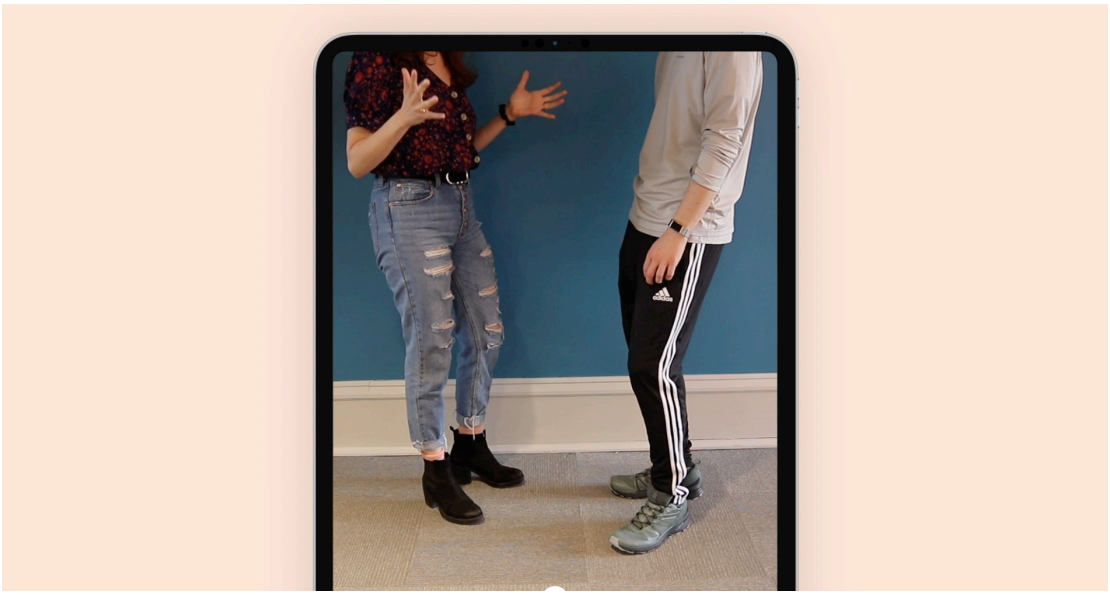


Figure 38
Users are introduced to the couple and situation they will enact

Study Outcomes

Insight into user's sentiment of Private Conversations was much more positive than negative. Research participants found the intervention valuable because of the variety of conversations it enabled them to enact and the insight it could provide. At the same time, some participants did not believe that Private Conversations would create a "safe space" for a couple. Others saw the game as "empowering" to some, in that it gave a user the tools to navigate tough conversations with their partner. Other insights include:

Private Conversations could confront challenges affecting behavior change

Similar to Intimately and Curb, lessons learned when interacting with Private Conversations may not be easy to implement and practice in real-life. To address this challenge, Private Conversations might explore ways to engage a couple beyond its core interaction (i.e., enacting a conversation).

Private Conversations could explore alternative game mechanics (i.e., instead of partners being on the same team, could they enact a conversation with each other)

In its current conception, Private Conversations enables a couple to work together to enact a conversation. While beneficial, some couples might find it more constructive if they were on different sides of a conversation or playing against another couple. The introduction of such mechanics could provide very different insights to an intimate partner.

Study Synthesis

Private Conversations enabled me to consider whether simulations in the context of an intimate relationship could be a tool for amusement and learning. While also providing an environment to experiment with different forms of feedback. What follows are principles collected when testing Private Conversations.

Private Conversation should afford numerous opportunities for reflection

Like some of the other concepts, Privates Conversations should integrate moments of reflection throughout. These moments will allow a user to recognize the different possible paths a conversation could take and the effect their decisions had on that conversation (i.e., if I said this, instead of that, in what direction would this conversation go?).

Private Conversations should allow a couple to enact a variety of conversations

Part of the beauty of intimate relationships is the diversity of their makeup. While it would be easier not to avoid representing that diversity, Private Conversations should do it best to convey a complete representation of the conversations an intimate couple can have. This way individuals and couples from all walks of life can benefit from the game.

Private Conversations should employ a variety of feedback mechanisms

Similar to what was seen with Bedtime Visions, it is essential that Private Conversations evolves the ways it provides feedback as it becomes more familiar with a couple (i.e., if Private Conversations finds that a couple is not responding to a form of feedback, it should modify the way it provides feedback to that couple). By not evolving, the game will not be able to create a constructive environment for that couple.

Figure 39
Users choose which side to enact

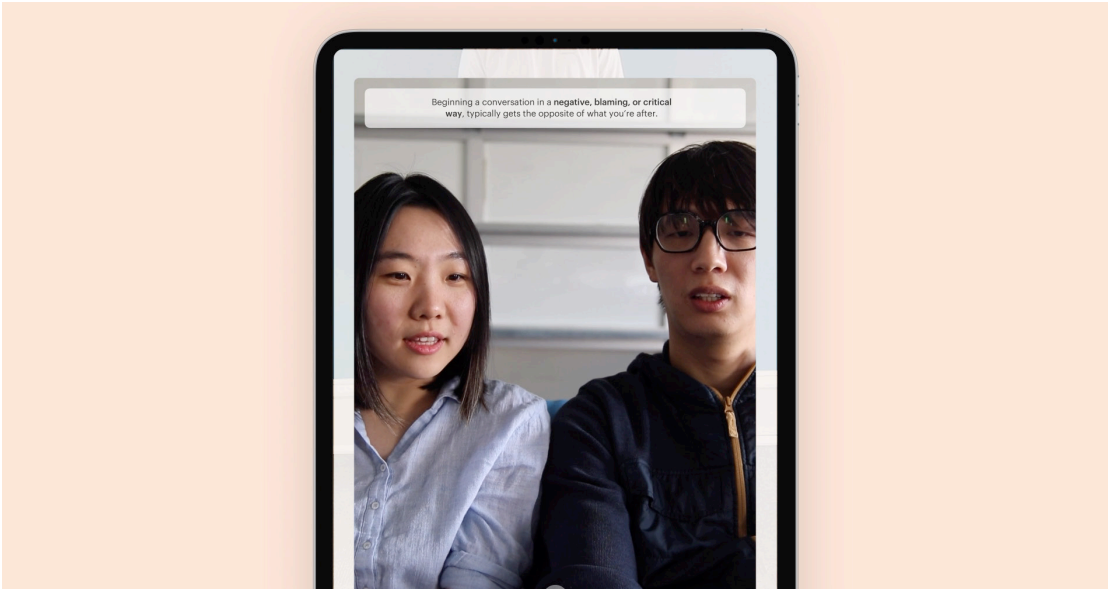


Figure 40
Users receive feedback related to conversation

Private Conversations agent should be viewed as passive participants

If Private Conversations were to provide a continuous stream of commentary to a couple, that couple would most likely find themselves oversaturated. For this reason, Private Conversations should employ artful methods of encouragement (i.e., if Private Conversations finds that a couple is overly focused on one aspect of a conversation, the game could guide the conversation in a totally different direction).

Private Conversations should take several different forms

By enabling a couple to enact conversations intimate couples have, a couple can build a greater understanding of how to have a constructive conversation instead of a deconstructive conversation. Thus, enacting those conversations on an iPad is not right for everyone, making it necessary for Private Conversations to live on a variety of devices.

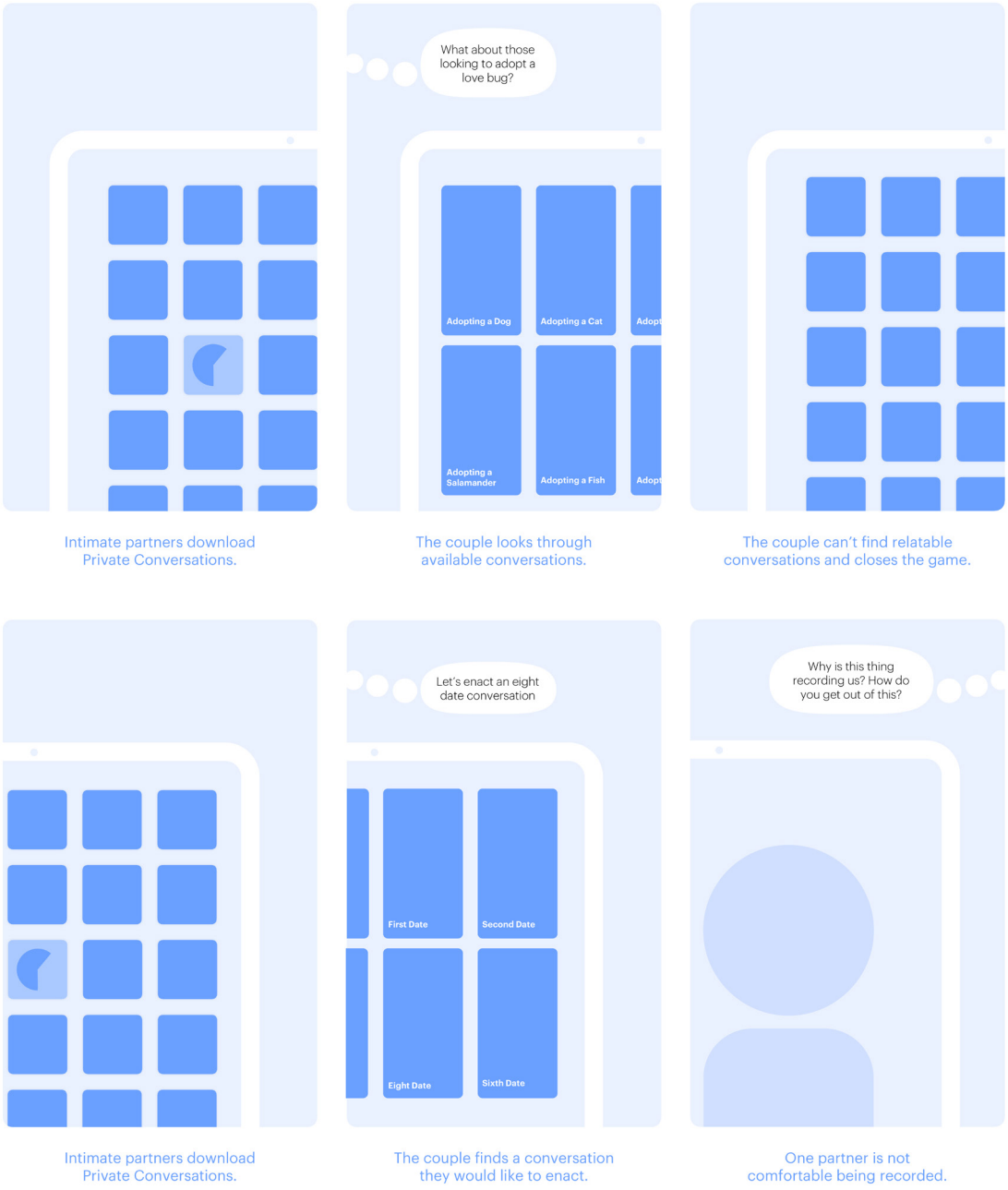
Unfavorable Directions

Storyboards depicting potentially unfavorable directions that involve Private Conversations focused on the following situations:

- Private Conversations inadequately representing the diversity of intimate conversations (See Figure 41).
- A couple that is uneasy simulating a conversation on a tablet (See Figure 42).

Considerations for the Future

Themes found in these storyboards include the need for diverse representations of intimate relationships and channels that enable a couple to engage. A consideration of the experiences that Private Conversations depicts is needed to ensure that it functions well for a diversity of couples, and serves couples participating in unconventional practices. Further attention must be paid to the various mediums an intimate couple will use to interact and converse.



Figures 41 and 42
Private Conversations inadequately representing the diversity of intimate conversations (above) and a couple that is uneasy simulating a conversation on a tablet (below) storyboards

Summary

Going into the generative phase of this thesis, I aimed to create and evaluate a diverse set of artificial agents designed to enhance an intimate partners' capacity for expression and understanding. I prototyped five artificial agents—each addressing different aspects of an intimate relationship—that revealed both opportunities and challenges. These prototypes revealed the opportunity for an agent to support a diversity of conversations/contexts and evolve its voice as it becomes more familiar with an intimate couple. The challenges I identified include affecting behavior change in partners and employing unconscious bias through agents.

Knowledge gleaned from these activities and the storyboards connected to the unfavorable direction storyboards enabled me to conclude this thesis with the following synthesis of work.

Synthesis of Work

Challenges

While it is important to consider the opportunities that each of these concepts provide, it is also important to look at the challenges each of these prototypes bring to light. For instance, many of these concepts are not possible with the current state of natural language processing and a considerable amount of additional work would need to be conducted to address the integration of these agents into a user's everyday life. The following is a catalog of those challenges, and theories on how they might be addressed.

Understanding the developing landscape of AI to ground designs in the state of the art and speculate future developments

Even with the considerable developments in the field of artificial intelligence, sentiment analysis tasks are still limited to analyzing the polarity of a piece of text and dialogue tasks where a system tracks what a user wants from the system at each step, while communicating with that user still has approximately a 75% accuracy rate. Until sentiment analysis parses text beyond two dimensions, and the accuracy of dialogue tasks improves, additional frameworks will need to be developed that enable an agent to take a position similar to those found within the concepts I have explored.

Finding effective ways to consistently affect behavior change

When developing these concepts, I paid particular attention to the effect they could have when a couple interacts with them for the first and second time. While I considered how an agent's relationship with an individual or couple might evolve over time, further study is warranted to fully understand that evolution and enable an agent to positively affect that individual or couple in the long run.

Helping couples acknowledge the potential ways that they can improve their relationship

One comment that seemed to pop up in some of my conversations with research participants was that a concept could really help other couples, but they had a hard time seeing how their relationship could benefit from such an intervention. Although this statement may be true, it may also confirm what a participant conveyed to me, when he said "we think we are good communicators when we are not". Bedtime Visions, Private Conversations, and my other concepts were attempts at challenging the notion that an individual or couple's current capacity for expression and understanding is fixed. Advancing these concepts and others so that individuals overcome the stigma associated with getting relationship help is a logical next step. The results of such work could provide individuals and couples who are not ready to seek out professional help with beneficial support.

Designing ways to consistently engage a user over time

When designing these concepts I paid particular attention to the first set of interactions an individual or couple might have in an experience. While those interactions may play a key role in engaging a user and highlighting the value of that experience, it may be no better than a self help book or an app if it does not consistently engage that user over a long period of time. An experience that evolves over time with a user could provide this value, making it both constructive and engaging.

Principles Derived

All phases enabled me to develop a number of principles to assist those who design for dimensions that make us human and cannot be easily measured. The following is a list of those principles gathered, framed, and written for a designer working specifically within the context of an intimate relationship and designing for expression and understanding. By providing these principles I believe designers can recognize deficiencies and opportunities within their design process.

Effectively Integrate

Integrate and frame interfaces so that the intimate relationship is at the center of the interaction.

Allow For Diversity

Support a diversity of couples (i.e., those involved in very different practices, those that employ a variety of communication methods, those at very different stages of their relationship).

Design For Support

Support rather than direct a couple (i.e., push couples to reflect on their relationship from different perspectives).

Evolve Over Time

Enable an experience to evolve as intimate partners' interact more with an agent (i.e., provide support customized to that couple, employ learnings from previous experiences).

Think Through Controls

Consider the tradeoffs of controls. For instance, if a user is allowed to choose specific metrics, could the design evoke greater bias in a relationship? What aspects of an experience is a user permitted to adjust?

Reveal the Good with the Bad

Reveal both the positives and negatives of a relationship and its exchanges.

Create Moments of Contemplation

Establish touch points for reflection (i.e., How can a person more effectively express themselves to their partner? How might an agent interpret those actions?) beyond an intimate partners' core interaction with an experience.

Study Attitude Changes Towards the Artificial

Understand that an individual's attitude towards the artificial is constantly evolving (i.e., individuals have very different concerns about agents and individuals concerns over data privacy may change).

Potential Application

I hope this work not only serves as a lodestar for what works and what doesn't, but also as inspiration for interfaces that enhance an intimate partners' capacity for expression and understanding while exploring the relationship between humans and artificial agents beyond the dimensions of efficiency, effectiveness, and productivity. While the concepts I prototyped need to be developed further before they are can productively integrate themselves into a couple's life, they provide me with a strong foundational understanding for how this project could advance.

Next Steps

Further work could focus on three areas: iterations of existing concepts, iterations of new concepts, and continuous work on addressing existing challenges. It would also be beneficial for existing concepts to be continuously evaluated as AI continues to develop. New considerations towards both the technology and the attitudes towards that technology ought to be taken into account.

Iterations of Existing Concepts

Evaluative research in the generative phase inspired a number of new concepts that I was unable to explore over the course of this year. These concepts vary in their scale of change—some alter the thinking that ground the specific idea while others are adjusted in very small ways.

Intimately

One comment I received about Intimately was that it took a very deterministic approach to supporting relationships. Users received one alternative and were then compelled to make a decision between two options, when in reality the options for what could be said are boundless.

An iteration of Intimately that could address this issue may provide different amounts of guidance based on the amount of time a user contemplates the message in question (See Figure 1). For example, a user might open Intimately and see a message from their partner. If that user immediately responds to that message, Intimately would remain in the background, passively analyzing the conversation. If instead, Intimately finds that the partner is deliberating over the message (i.e., continuously revising the message, typing something and looking at the message for 30 seconds before typing something else), Intimately would take an active approach. But instead of providing an alternative it would provide counsel related to that message and the larger context of that conversation.

Curb

A number of research participants saw value in Curb, but also stated that after using the tool a few times they would be annoyed and possibly agitated by having this virtual-assistant voice interrupting their conversation. This caused me to consider the feasibility and benefit of having a similar dynamic, but posture the interruption in a less personal, calculable, and predictable way. With this in mind, I developed an iteration of Curb, where instead of having the agent ask the partner "Is that what you meant to say?", Curb would play a popular piece of music with lyrics related to that conversation (See Figure 2). The intention would be to surprise an individual and enable them to take a reflective approach towards their conversation with less of the annoyance and agitation associated with the virtual assistant voice.

Bedtime Visions

Through evaluative research, I recognized the opportunity for Bedtime Visions to support a larger system of conversations that supports a couple in a variety of settings, especially those that are ideal for certain conversations. For instance, one could build an iteration of Bedtime Visions specifically for a bathroom that supports the verbalization of those inner conversations someone has with themselves while sitting on the toilet, or an iteration designed for the kitchen as a couple decides what and where to eat (See Figure 3).

Dinner Time Visualizations

While evaluating Dinner Time Visualizations, some research participants shared that both the visual language and form of Dinner Time Visualizations could draw an individual out of the conversation. A new iteration of Dinner Time Visualizations that addresses this comment would include a stripped down visual language (i.e., evolving gradients of colors) and a reduced presence in a room (i.e., the visualization takes up small picture frames not in the direct eye path of a partner that a partner could glance at from time to time; See Figure 4).

Iterations of New Concepts

I would also like to continue to work on a number of the concepts developed early in the generative phase like the memory book, which is a book that collects qualitative descriptions of a couple's time together (See p. 73), the family movie toy set, which is a toy set for children to shoot scenes based on their life at home and designed so that parents can see what their children notice about their relationship that they have missed (See p. 73), and Headspace for Intimate Relationships, which is a platform focused on the health of an intimate relationship that could combine a number of different aspects that are prevalent in the concepts that I have developed and prototyped (See p. 72).

Addressing Existing Challenges

As I continue working on existing and new concepts I will continue to address the challenges I mentioned earlier, in an effort to create agents that can integrate into and positively affect the everyday lives of individuals and couples.

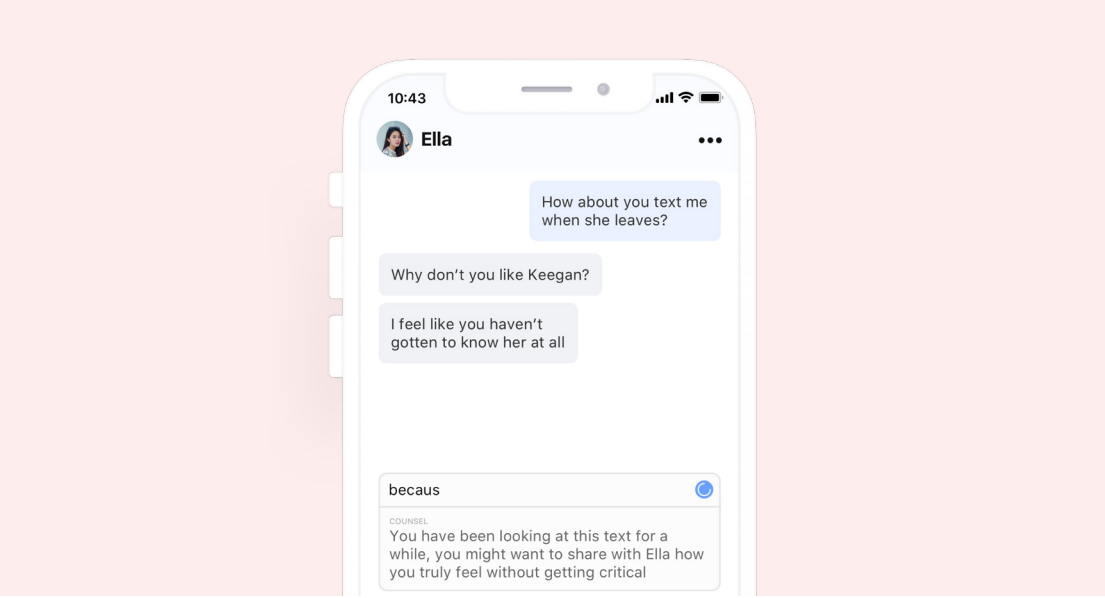


Figure 1
An iteration of Intimately that provides different amounts of guidance based on the amount of time a user contemplates a message

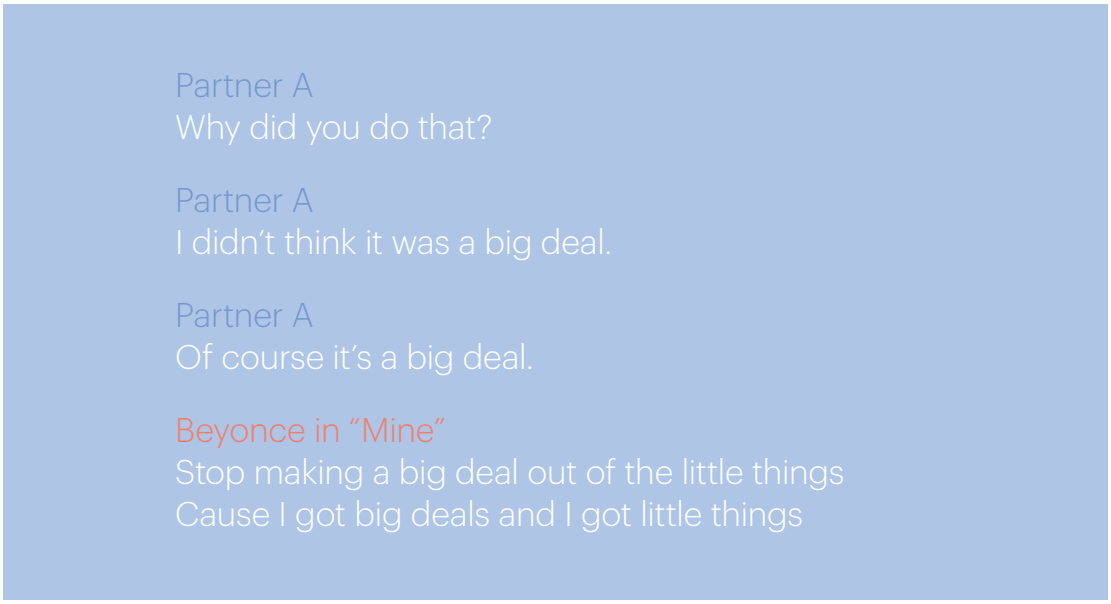


Figure 2
An iteration of Curb that would play a popular piece of music with lyrics related to triggering comment

Partner A
Hey Bedtime Visions, help us decide where to go eat.

Bedtime Visions
Ok. To start what type of chairs would you like to sit in. Any desire to sit on the same side of the booth or are regular chairs fine?

Partner B
ummm...

Figure 3
An iteration of Bedtime Visions that supports a couple in a variety of settings

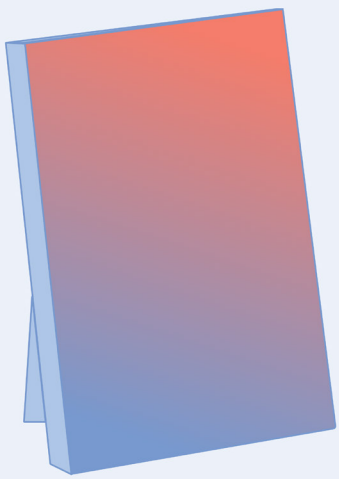


Figure 4
An iteration of Dinner Time Visualizations with a stripped down visual language that takes up a small picture frame

Summary

In this thesis, I explored the ways an artificial agent can enhance an intimate partners' capacity for expression and understanding in their relationship. Not only are intimate relationships often our most defining and determining relationships, but they also serve as a context full of qualitative dimensions that make us human. I characterize these dimensions as our ability for self-expression and for understanding others, the emotional and intellectual mechanisms we employ, the vast differences in our makeup and experiences, our propensity to make the same errors more than once, and our idiosyncrasies. Designers typically do not consider the complexities of this space when working with artificial agents. However, given the ever-increasing influence of artificial agents comes the need for studies to interrogate how an agent can positively affect an individual beyond the qualitative dimensions we commonly see embedded in products today.

My study is meant to serve as a guide for anyone interested in learning how designers might address those dimensions that make us human in intimate relationships, as well as contexts that extend into relationships between family members, co-workers, teachers, and students. I aimed to highlight how artificial agents in these contexts can be approachable, appealing, and impactful to a general audience, while also illustrating the need for positive and nuanced depictions of agents. Ultimately, I hope to provide insights into how an artificial agent can enhance an intimate partners' capacity for expression and understanding, help a partner understand themselves, their partner, and their relationship, and support a diversity of intimate relationships, no matter the shape or size.

References

Adobe After Effects. (n.d.). Retrieved from https://www.adobe.com/products/aftereffects.html.

About Lemonade. (n.d.). Retrieved from https://www.lemonade.com/faq.

Amazon Mechanical Turk. (n.d.). Retrieved from https://www.mturk.com/.

Angus, I. H. (1980). Towards a philosophy of technology (book review). *Research in Phenomenology,* 10, 320. Retrieved from https://search-proquest-com.proxy.library.cmu.edu/docview/1300036138?accountid=9902.

Bird, J & Di Paolo E. (2008). *Gordon Pask and his maverick machines; The mechanical mind in history.* Retrieved from https://s3.amazonaws.com/academia.edu.documents/31020037/Husbands_08_Ch08_1 85-212.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1510327046&Sig nature=kGW8ucV%2BzVqTaPMuqzzRD4qT4kQ%3D&response-content-disposition=inline%3B%20filename%3DGordon_Pask_and_his_maverick_machines.pdf.

Brodey, W. M., and N. Lindgren. (1967). *Human enhancement through evolutionary technology.* IEEE Spectrum 4:87–97.

CakeChat. (n.d.). Retrieved from https://cakechat.replika.ai/.

Conversation. (2019) In Oxford English Dictionary. Retrieved from http://www.oed.com.proxy.library.cmu.edu/view/Entry/40748?rskey=ihPKEP&result=1&isAdvanced=false#eid.

Dale, G. (n.d.) Your chatbot needs a personality. Retrieved from https://medium.com/@gregdale/your-chatbot-needs-a-name-b8f92f337386.

Dialogflow. (n.d.). Retrieved from https://dialogflow.com/.

Dirksen, J. (2012) *Design for how people learn*. Berkeley, CA: New Riders.

Dorst, K. (2015). F*rame innovation: Create new thinking by design*. Cambridge, MA. The MIT Press.

Dr. Laura Call of the Day Dr. Laura Schlessinger. (n.d.). Retrieved from https://podcasts.apple.com/us/podcast/dr-laura-call-of-the-day/id721006934.

Dubberly, H. & Pangaro, P. (2009, May 1). What is conversation? How can we design for effective conversation?. Retrieved from http://www.dubberly.com/articles/what-is-conversation.html.

Dubberly, H. & Pangaro, P. (2011, January). Introduction to Cybernetics and the Design of Systems. Retrieved from https://www.pangaro.com/CUSO2014/Cybernetics_Book_of_Models-v4.6b-complete.pdf.

Experience. (2019). In Oxford English Dictionary. Retrieved from http://www.oed.com.proxy.library.cmu.edu/view/Entry/66520?rskey=VqY2tn&result=1&isAdvanced=false#eid.

Fingas, J. (2015, August 26). Facebook 'M' makes Messenger your personal assistant. Retrieved from https://www.engadget.com/2015/08/26/facebook-messenger-m-assistant/.

Fluidity. (2019). In Oxford English Dictionary. Retrieved from http://www.oed.com.proxy.library.cmu.edu/view/Entry/72093?redirectedFrom=fluidity#eid.

Fog of Love Board Game. (n.d.). Retrieved from https://www.walmart.com/ip/Fog-of-Love-Board-Game-Exclusively-Sold-on-Walmart-com-Male-Female-Cover/520738534.

Ghoshal, A. (2016, September 22). 5 things I wish Google Allo could do. Retrieved from https://thenextweb.com/apps/2016/09/22/5-things-i-want-allo-to-do/.

Grice, H. P. (1975). Logic and Conversation. *Syntax and Semantics, 3, Speech Acts*, 41-58.

Google. (2019). Google Allo - A smart messaging app. Retrieved from https://allo.google.com/.

Hall, E. (2018). *Conversational Design*. New York, NY: A Book Apart.

Hatch Club. (n.d.). Retrieved from http://hatchimals.com/en_us/hatch-club.

Dreher, T. (n.d.). History of Computer Art. Retrieved from http://iasl.uni-muenchen.de/links/GCA-II.3e.html.

Hookway, B. (2014). *Interface*. Cambridge, MA: The MIT Press.

Interface. (2019). In Oxford English Dictionary. Retrieved from http://www.oed.com.proxy.library.cmu.edu/view/Entry/97747?rskey=9vUcQq&result=1&isAdvanced=false#eid

Jacquard by Google. (n.d.). Retrieved from https://atap.google.com/jacquard/.

Kaito_Kid (2018) Replika Research. Retrieved from https://www.reddit.com/r/replika/comments/7s2izd/replika_research_has_anyone_else_had_a_creepy/.

Kaplan, R. (2013, March 21). Beyond the GUI: It's Time For a Conversation User Interface. Retrieved from https://www.wired.com/2013/03/conversational-user-interface/.

Lasting: Marriage Health App. (n.d.). Retrieved from https://www.getlasting.com/.

Leviathan, Y & Matias Y.. (2018, May 8). Google Duplex: An AI System for Accomplishing Real-World Tasks Over the Phone. Retrieved from https://ai.googleblog.com/2018/05/duplex-ai-system-for-natural-conversation.html.

Licklider, J. C. (1960). Man-computer symbiosis. *IRE transactions on human factors in electronics*, (1), 4-11.

McCarthy, B. (1980). *The 4MAT system: Teaching to learning styles with right/left mode techniques*. Arlington Heights, Ill: EXCEL.

Men Are From Mars, Women Are From Venus. (n.d.). Retrieved from https://www.marsvenus.com/p/men-are-from-mars-women-are-from-venus-hardcover.

Miller, R. (2012). *Intimate Relationships* (6th ed.). New York, NY: McGraw-Hill.

Monogamy Adult Couples Board Game. (n.d.). Retrieved from https://www.amazon.com/Monogamy-Adult-Couples-Board-Game/dp/B0001VVQ3I.

Negroponte, N. (1970). *The Architecture Machine: Towards a more human environment*. Boston: MIT Press.

Objectifier. (n.d.). Retrieved from https://bjoernkarmann.dk/objectifier.

Pangaro, P. (2002). The Architecture of Conversation Theory. Retrieved from http://pangaro.com/L1L0/ArchCTBriefly2b.htm.

Pangaro, P. (2011, September 11). Design for Conversations & Conversations for Design. Retrieved from http://www.pangaro.com/conversations-for-innovation.html.

Pardes, A. (2017, November 12). What My Personal Chat Bot Is Teaching Me About AI's Future. Retrieved from https://www.wired.com/story/what-my-personal-chat-bot-replika-is-teaching-me-about-artificial-intelligence/.

Pask, G. (1976). *Conversation Theory: Applications in Education and Epistemology.* Amsterdam: Elsevir.

Pillow Talk. (n.d.). Retrieved from http://www.littleriot.com/pillow-talk.

Progression. (2019). In Oxford English Dictionary. Retrieved from http://www.oed.com.proxy.library.cmu.edu/view/Entry/152238?redirectedFrom=progression#eid.

RELEX Cuddle. (n.d.). Retrieved from https://vimeo.com/304437115.

Salvador, P. (2015, August 26). Majestic. Retrieved from https://obscuritory.com/other/majestic/.

Sareem, H. (2018, June). Project Oasis. Retrieved from https://experiments.withgoogle.com/oasis.

SDK. (n.d.). Retrieved from https://www.affectiva.com/product/emotion-sdk/.

Skirpan, M., Cameron, J., & Yeh, T. (2018). *Quantified Self: An Interdisciplinary Immersive Theater Project Supporting a Collaborative Learning Environment for CS Ethics.* SIGCSE.

Skirpan, M. (n.d.) Mike Skirpan. Retrieved from http://mwskirpan.com/.

Simonite, T. (2017, April 14). Facebook's Perfect, Impossible Chatbot. Retrieved from https://www.technologyreview.com/s/604117/facebooks-perfect-impossible-chatbot/.

SMS. (n.d.). Retrieved from https://www.twilio.com/sms.

Tea & Empathy Feeling Cards. (n.d.). Retrieved from https://www.kickstarter.com/projects/katekenfield/tea-and-empathy-feelings-cards.

The Boyfriend Log. (n.d.). Retrieved from https://theboyfriendlog.com/.

The Internet Phone. (n.d.). Retrieved from https://www.jamesxzhou.com/work/theinternetphone/.

Touch Room. (n.d.). Retrieved from http://pablorochat.com/touch-room.

von Glasersfeld, E. (1995). Radical Constructivism: A Way of Knowing and Learning. London: The Falmer Press.

Wallace, R. (n.d.). *From ELIZA To A.L.I.C.E.*. Retrieved from http://www.alicebot.org/articles/wallace/eliza.html.

Weizenbaum, J. (1966). *Eliza -- A Computer Program For the Study of Natural Language Communication Between Man and Machine*. Retrieved from https://f1000.com/work/item/3090598/resources/3485660/pdf.

Winograd, Terry. (1987, May 14). A Language/Action Perspective on the Design of Cooperative Work. Retrieved from https://hci.stanford.edu/winograd/papers/language-action.html.