

Persuasion Invasion: Reducing Bias with Value-Adaptive Instruction

Nicholas Diana
ndiana@colgate.edu
Colgate University
Hamilton, NY

John Stamper
john@stamper.org
Carnegie Mellon University
Pittsburgh, PA

Jessica Hammer
hammerj@andrew.cmu.edu
Carnegie Mellon University
Pittsburgh, PA

Kenneth Koedinger
koedinger@cmu.edu
Carnegie Mellon University
Pittsburgh, PA

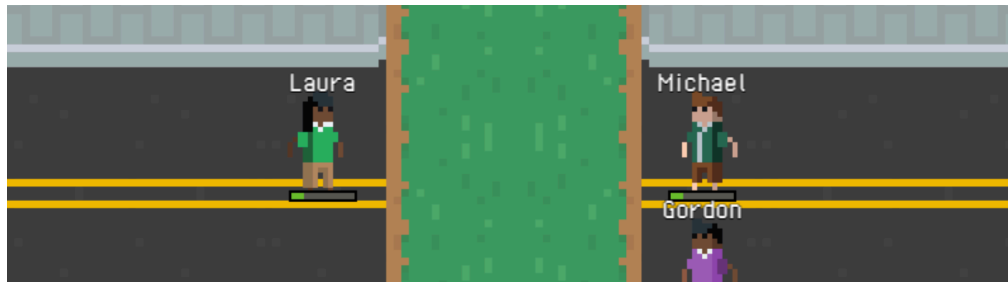


Figure 1: A screenshot of Persuasion Invasion, in which players learn to identify shared values and reduce tribalism in an effort to fend off extraterrestrial invaders.

ABSTRACT

As civil discourse in America is becoming less substantive and respectful [2], some educators have turned to educational games as a potential solution. However, providing effective instruction on key civic skills (e.g., perspective taking) requires a level of individualization that is unscalable in traditional classroom environments. Here we present *Persuasion Invasion*, an educational game that uses Value-Adaptive Instruction to help students learn to engage in productive civil discourse (i.e., discourse that fosters democratic goals [9]). Throughout the game, players learn about the values that underpin our beliefs and barriers to productive discourse (e.g., tribalism and bias). We tested a scalable, value-adaptive intervention, and found that we were able to estimate and, in some cases, reduce the impact of bias when reasoning about political arguments.

CCS CONCEPTS

• **Applied computing** → **Interactive learning environments;**
Computer games;

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

CHI PLAY '20 EA, November 2–4, 2020, Virtual Event, Canada

© 2020 Copyright held by the owner/author(s).

ACM ISBN 978-1-4503-7587-0/20/11.

<https://doi.org/10.1145/3383668.3419927>

KEYWORDS

Civics; Education; Games; Adaptivity; Rhetoric; Bias

ACM Reference Format:

Nicholas Diana, Jessica Hammer, John Stamper, and Kenneth Koedinger. 2020. Persuasion Invasion: Reducing Bias with Value-Adaptive Instruction. In *Extended Abstracts of the 2020 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '20 EA)*, November 2–4, 2020, Virtual Event, Canada. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3383668.3419927>

1 MOTIVATION

Where and how we engage in political discourse is changing. Recent years have seen rising partisan antipathy [1] and the movement of political discourse from in-person to online spaces. These changes have coincided with increasing pessimism about the state and future of civil discourse in America, with most Americans believing that civil discourse has become less focused on issues, less fact-based, and less respectful in recent years [2]. This is particularly true for online civil discourse, which most Americans find “stressful and frustrating” to engage in [3].

A key skill that supports productive civil discourse is *Perspective Taking*, or the ability to objectively consider the merits of a viewpoint other than your own. Designing effective instruction for this skill requires that we know the *values of the player* as well as the *values latent in the text* they are reading. When these two sets of values are aligned (i.e., when the reader agrees with the argument they are reading), they are less likely to objectively evaluate the argument, a phenomenon called *Myside Bias* [10]. Understanding

our biases and when we are most susceptible to bias is a critical skill for fighting against the formation and perpetuation of information bubbles.

Importantly, expert teachers recognize the impact of bias in shaping how students reason about political arguments. For example, if a teacher knows a student is pro gun-rights, they might assign that student to defend a pro gun-control position – effectively forcing the student to engage in perspective taking. Unfortunately, this kind of *Value-Adaptive Instruction* (i.e., instruction that adapts to the specific values of the student) is unscalable through this traditional approach. It is unreasonable to ask a teacher to know the beliefs of each of their students with respect to every topic they discuss and then to adapt instruction to each student according to those beliefs.

To this end, we designed *Persuasion Invasion*, an educational game designed to give players practice engaging in productive civil discourse. As a research tool we used the game to explore whether we can, for the first time, leverage theoretical estimates of user values alongside data-driven estimates of content values to provide value-adaptive instruction in a scalable way.

2 KEY INNOVATION: VALUE-ADAPTIVE INSTRUCTION

The key innovation of this work is a new method for adapting instruction based on the relationship between a user’s values and the values latent in the content the user is reasoning about. This new method, which we call *Value-Adaptive Instruction* (VAI), is grounded in established theories from social psychology such as Constructive Controversy [6] and Moral Foundations Theory [5]. VAI leverages these theory-driven estimates of user values alongside data-driven estimates of the values latent in text (derived using Distributed Dictionary Representations [4], a natural language processing method). In *Persuasion Invasion* this information is used to dynamically adapt the content that players encounter throughout the game. Using VAI, we can predict when a student may be most susceptible to biased reasoning, and provide a targeted intervention designed to prime their critical thinking faculties and reduce bias.

3 DESIGN CHOICES

This section describes some of the intentional design choices that shaped the goals, mechanics, and content of the game. But first, it may be helpful to have a working knowledge of the premise and primary objective of the game: In *Persuasion Invasion*, the world is under attack by a species of aliens invaders. However, because these aliens are pacifists, the aliens conquer planets by slowly sewing discord and division in small communities. When the community is unable to come together to solve even the most basic problems – that’s when they strike! Players assume the role of a government agent, and are tasked with bringing communities together. They do this by employing civil discourse moves that reduce tribalism and identify shared values across political lines.

3.1 Alien Invasion

Using an alien invasion as the overarching threat serves a number of purposes. First, the kinds of activities that the aliens engage in throughout the game helps establish the alien invasion as a soft metaphor for the threat of foreign interference in our elections. The idea of an alien invasion is also instantly understandable and motivating, and that is in part due to the second (and more important) reason for using an alien invasion: existential threats change our perceptions of what is important. Although the players will be grappling with emotionally evocative political issues that might normally polarize communities into their political tribes, the ever-present existential threat will constantly remind players of the community’s shared goals and interests – effectively positioning both sides of the political divide as part of a larger, world-tribe.

3.2 Townsquare

In each level of the game, the player’s primary objective is to persuade each townspeople to move into the Townsquare. Again, this movement to the Townsquare does not represent a change in belief, but simply a willingness to engage in earnest and meaningful dialogue with those they disagree with. Townspeople with different beliefs are positioned either to the left or right of the town-square. This is intentionally meant to evoke the prevailing (if not overly-simplistic) real-world dichotomy of a two-party system. The main purpose of the positioning of townspeople is so that as players persuade individual townspeople to move into the Townsquare, that productive action is reinforced visually as players see the townspeople physically coming together into a shared space.

3.3 Isolation

While it may seem counter-intuitive to design a single-player game for teaching discourse skills (a social activity), there are actually some key benefits of isolated gameplay. First, by taking players out of their normal social context, players can explore their own values and beliefs without pressure from their peers (or family) to conform to the established beliefs of a particular tribe. Second, the simulated social context of our game allows students to take risks and understand the consequences of discourse actions in a way that is impossible in real social contexts, where a poor decision could cause the student to lose face with their peers.

4 GAME CONTENT

4.1 Scenarios

Each level of the game centers around a scenario, which describes a topic or decision that has divided public opinion. Based on insights from our structured interviews with expert instructors, we designed each scenario to be both emotionally evocative and relevant to student lives. While some of the fictional scenarios have real-world analogues (e.g., immigration), we intentionally avoided using well-known, hot-button issues, as students might be inclined to, for example, simply regurgitate the beliefs of their parents about the topic. Using an analogue forces students to form their own beliefs, and hopefully better understand their values in the process.

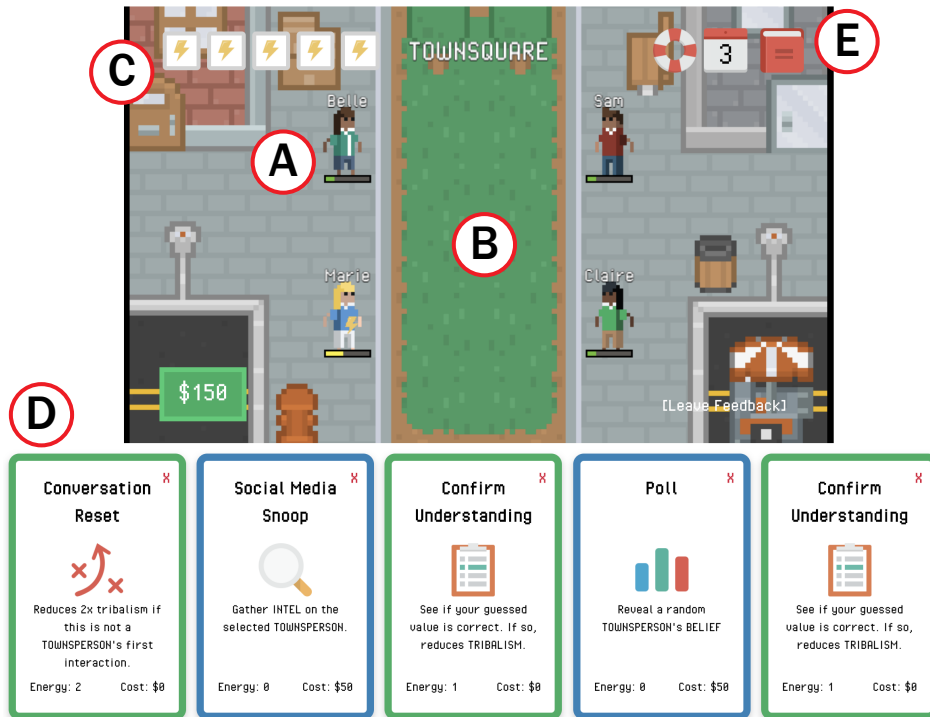


Figure 2: An annotated screenshot of a scenario. In each scenario, players must persuade NPCs like Belle (A) to move into the TOWNSQUARE (B). To do this players must identify which argument from the opposing side appeals to what Belle values. Persuading NPCs costs Energy (C). The bar positioned below each NPC represents their political tribalism. Players must reduce an NPC’s tribalism before attempting to persuade them. They can do this by playing Discourse Cards (D) like *Conversation Reset*. Finally, the action menu (E) allows the player to request a hint, end the day/turn, or reference information in their notebook.

4.2 Discourse Cards

In *Persuasion Invasion*, civil discourse moves are represented by cards that the player can spend energy and/or money to play. Discourse Cards are divided into three categories: *Tribalism Cards* which reduce a townspeople’s tribalism, *Intel Cards* which provide clues to a townspeople’s values, and *Value Cards* which appeal directly to a certain value.

In the current iteration, the player only has access to productive discourse cards, but unproductive discourse cards (i.e., cards that increase tribalism) are available to the alien invaders. The inclusion of unproductive discourse moves helps define what make the productive discourse moves good. Additionally, although unproductive moves necessarily have a negative consequence, astute players may be able to derive useful information about a townspeople’s values even from this negative interaction. This is similar to how seeing a friend share a debunked news story is undeniably bad, but it can also reveal what kinds of things that friend cares about.

4.3 Notebook

Playtesters have described the gameplay as similar to being a detective and slowly uncovering the beliefs and values of a town

through these interactions. To help keep track of all this information, players are given a digital notebook that automatically updates when they gather intel about a townspeople. This notebook also allows players to track what values they might think a townspeople cares about. These data are recorded and can be used in a confusability analysis to evaluate the quality of the game content.

5 GAMEPLAY

Gameplay is turn-based, revolving around the concept of days, with players acting during the day and aliens acting during the night. At the start of each day, the player’s energy is restored to 5 Energy Points, and they gain some additional money. Additionally, new cards are automatically drawn from the deck until the player has a hand of 5 cards. During their turn, players can spend their energy and money to play discourse cards from their hand, which reduce tribalism and reveal clues about what a townspeople values. When the player believes they have identified the value of a townspeople and has reduced their tribalism, they can try to *Persuade* that townspeople to move into the townsquare (which costs 2 Energy Points). The *Persuade* action asks players to choose an argument from the opposing side that appeals to the target townspeople’s value. For example, if a townspeople values the *Care*

foundation and is concerned about the health risks involved in letting kids play football, you might present the argument that, “Football teaches skills like leadership and determination. It does more good than harm.” This is a belief held by the opposing side, but still appeals directly to the townspeople’s value (Care).

When the player exhausts their energy or money, they can choose to end the day. Night falls and the alien’s turn begins. During which, the alien can play their own cards to increase tribalism. The effects of these cards are illustrated with the use of a spaceship tractor beam that highlights the townspeople being targeted. Importantly, aliens cannot effect a townspeople who has already moved into the townsquare.

6 PRELIMINARY RESULTS

We conducted a user study to explore the impact of our value-adaptive intervention on bias while evaluating arguments in *Persuasion Invasion*. The game was integrated into Social Studies and English classes at two local high schools, where a total of 87 students played the game. Upon their initial login, students were randomly assigned to one of two conditions: adaptive or control. The adaptive condition was identical to the control condition in every way, except that students were given an additional, adaptive intervention when they were asked to evaluate politically charged arguments.

We found that, over time, students in the adaptive condition were better able to overcome potential bias and, as a result, successfully complete the in-game tasks. However, we found that this was only true for students with high bias-regulation. Understanding why the intervention may be effective for some students but not others is the subject of future work. This work is limited first by the population it sampled from; it is unclear how the intervention would effect older participants (due to known interactions between age and myside bias [8]). Second, this work is limited by its largely US-centric game content. We expect, however, that the game could be adapted to other political contexts, as the authors of Moral Foundations Theory (upon which this work is built) argue that it applies universally [5].

7 IMPLICATIONS

While *Persuasion Invasion* addresses only a small number of the challenges in civic education space (e.g., the lack of practical civic skills and the unscalability of perspective taking practice), we believe *Value-Adaptive Instruction* has broader implications for any games that strive to accurately represent or improve human reasoning. First, as a bias estimation tool, VAI can help designers understand where and when their players may be exhibiting bias. Second, as a driver of adaptive interventions, VAI can be used to efficiently provide feedback precisely in those moments when it may be most useful.

More broadly, VAI represents a shift toward a more comprehensive and accurate view of human reasoning, where we acknowledge the powerful and important role of our values in shaping how we reason about politics (and moral judgments in general). VAI allows us to build adaptive game mechanics around bias, rendering

this typically unseen force visible and accessible to players. Exploring our values and our biases in this way can be incredibly challenging (e.g., see [7]), but it is perhaps something that games and other playful experiences are uniquely equipped to handle. Games allow the player to grapple with their biases in a non-threatening environment that puts emotional distance between the player and the character they are playing. Perhaps more importantly, insulated game environments allow players to explore their values outside of the pressures of their political tribe or social circle.

8 CONCLUSION

In this paper, we describe the civic education game *Persuasion Invasion* and its use of *Value-Adaptive Instruction* to estimate and, in some cases, reduce bias in a scalable way. This work illustrates how player bias can be used to adaptively drive game mechanics in a way that makes bias visible and accessible.

ACKNOWLEDGMENTS

The research reported here was supported, in whole or in part, by the Institute of Education Sciences, U.S. Department of Education, through grant R305B150008 to Carnegie Mellon University. The opinions expressed are those of the authors and do not represent the views of the Institute or the U.S. Department of Education.

REFERENCES

- [1] Carrol Doherty, Jocelyn Kiley, and Nida Asheer. 2019. Partisan Antipathy: More Intense, More Personal. *Pew Research Center* (2019).
- [2] Carrol Doherty, Jocelyn Kiley, Alec Tyson, and Bridget Johnson. 2019. Public Highly Critical of State of Political Discourse in the U.S. *Pew Research Center* (2019).
- [3] Maeve Duggan and Aaron Smith. 2016. The Political Environment on Social Media. *Pew Research Center* (2016).
- [4] Justin Garten, Joe Hoover, Kate M Johnson, Reihane Boghrati, Carol Iskiwitch, and Morteza Dehghani. 2018. Dictionaries and distributions: Combining expert knowledge and large scale textual data content analysis. *Behavior research methods* 50, 1 (2018), 344–361.
- [5] Jonathan Haidt. 2012. *The righteous mind: Why good people are divided by politics and religion*. Vintage.
- [6] David W Johnson, Roger T Johnson, and Dean Tjosvold. 2000. Constructive controversy: The value of intellectual opposition. (2000).
- [7] Jonas T Kaplan, Sarah I Gimbel, and Sam Harris. 2016. Neural correlates of maintaining one’s political beliefs in the face of counterevidence. *Scientific reports* 6 (2016), 39589.
- [8] Paul A Klaczynski and Billi Robinson. 2000. Personal theories, intellectual ability, and epistemological beliefs: Adult age differences in everyday reasoning biases. *Psychology and Aging* 15, 3 (2000), 400.
- [9] Zizi Papacharissi. 2004. Democracy online: Civility, politeness, and the democratic potential of online political discussion groups. *New media & society* 6, 2 (2004), 259–283.
- [10] Keith E Stanovich, Richard F West, and Maggie E Toplak. 2013. Myside bias, rational thinking, and intelligence. *Current Directions in Psychological Science* 22, 4 (2013), 259–264.