Impairment or Empowerment: Game Design to Reduce Social Stigma for Children with Physical Disabilities

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ABSTRACT:
Digital games can address social problems, such as the integration of marginalized persons into the community at large. For example, six children in a thousand live with an ambulatory disability. Communities must learn to accept children in wheelchairs. This social rehabilitation is problematic. It requires that hostile social environments, particularly the classroom, become more supportive. Issue awareness among classmates without disabilities can be improved by education-based interventions but such interventions rarely change behaviour. Interactive personal contact between able children and disabled role models has been shown to be effective but it cannot be readily scaled. Digital games offer an appealing intervention vector, easily scalable and highly interactive. This pilot study investigates game design that may promote social esteem.

KEY WORDS:
ATPD, game-based learning, linguistic bias, physical disabilities, serious game, social rehabilitation.

Introduction

Digital games can address very difficult social problems. Six in a thousand children have ambulatory disability[1], and society must learn to accept children in wheelchairs. More than physiological rehabilitation[2], social rehabilitation introduces unresolved problems. It requires that hostile social environments[3], particularly the classroom[4],[5] become more supportive. Issue awareness among classmates without disabilities[6] can be improved by education-based interventions[7] but such interventions rarely change behavior[8]. Interactive personal contact between able children and disabled role models is more effective[9] but this does not readily scale. Digital games offer an appealing intervention vector, easily scalable and highly interactive. Children who are disabled are usually aware of how others perceive them. They want their classmates without disabilities to know "who they are, what they dream of, and what they love to do". They do not want to be defined by their limitations.[10] Our research seeks to use a digital game to reduce the stigma with which mobility-normative middle-school students regard disabled classmates. The goal of reducing social stigma is not without peril. Insightful research by J. Crocker and B. Major[11] reached the counterintuitive conclusion that social stigma can *enhance* the self-esteem of individual members of the stigmatized class. The researchers identify three mechanisms: (a) Stigmatized individuals discount criticism they can consider biased. (b) Stigmatized individuals judge themselves against other members of their class, rather than more global standards. (c) Stigmatized individuals selectively assign weight to metrics in which their class excels and devalues those where it does not.

Classroom integration of differently-abled children, explicitly aims to reduce stigma. Its unintended consequence is to deprive children of the protection that stigma provided. In particular, it denies children those defense mechanisms that rely on isolation, such as the first two Crocker defenses: disregard of notionally biased criticism and in-group-only self-comparison. The third Crocker defense, weighting metrics to favor those in which the group excels, relies on neither stigma nor isolation. This reweighting of metrics can be achieved in any controlled environment in which the criteria of success are set by an authority. That condition precisely fits the game intervention in this study. Like all games, its win condition and scoring mechanism are established by its designers. Both the esteem of others and self-esteem can be elevated by demonstration of high competence[12]. Games are especially well-suited[13] to expose the special competencies[14] developed by people who have physical disabilities. F. Brasile[15] warns that integration of differently-abled populations may emphasize the disabilities of certain individuals rather than their abilities. He proposed that social engineers set up conditions in which the strengths of the disabled class are emphasized. In particular, he nominated wheelchair sports.

Research Methodology

We conducted a study to measure the immediate effect of short-term exposure to game-play that heavily valued wheelchair skills. The experimental design was pre-and-post test. Our development team produced a fully playable prototype game with a fixed duration to serve as the test intervention. We administered a standardized self-report survey to measure player attitude toward disabled persons before and after gameplay. We recruited students in the target age group from different schools to assure a wide range of socioeconomic diversity. No follow-up test was conducted to measure effect decay, nor did we study dose dependency by testing repeated or extended gameplay. *Hypothesis:* Exposure of able children to a game that values wheelchair manipulation skills will improve their attitude toward disabled children.

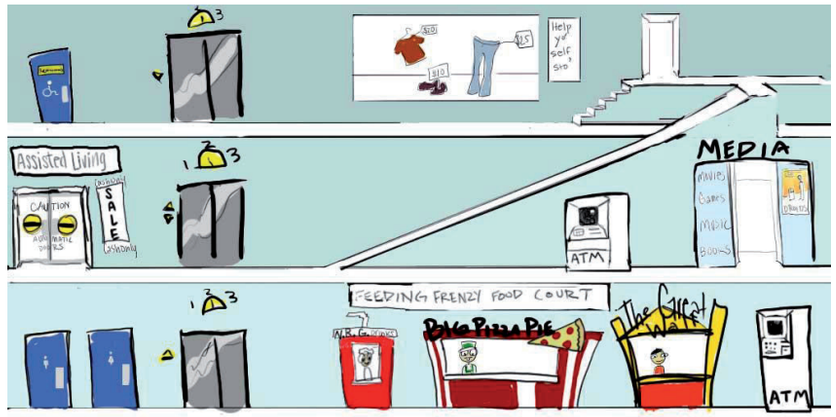
1 For more information, see: LAUER, E., HOUTENVILLE, A.: *Annual disability statistics compendium*. Durham, NH : University of New Hampshire, Institute on Disability, 2016.
2 VAN DER WOUDE, L., DE GROOT, S., JANSSEN, T.: Manual wheelchairs: Research and innovation in rehabilitation, sports, daily life and health. In *Medical Engineering & Physics,* 2006, Vol. 28, No. 9, p. 906-914.
3 McDOUGALL, J. et al.: High School-Aged Youths' Attitudes Toward their Peers with Disabilities: The role of school and student interpersonal Factors. In *International Journal of Disability, Development and Education,* 2004, Vol. 51, No. 3, p. 288-312.
4 ANABY, D. et al.: The effect of the environment on participation of children and youth with disabilities: A scoping review. In *Disability & Rehabilitation,* 2013, Vol. 35, No. 19, p. 1590-1597.
5 SWEARER, S. et al.: What can be done about school bullying? Linking research to educational practice. In *Educational Researcher,* 2010, Vol. 39, No. 1, p. 39-46.
6 TREPANIER-STREET, M. et al.: Young Children with and without Disabilities: Perceptions of Peers with Physical Disabilities. In *International Journal of Early Childhood Special Education,* 2011, Vol. 3, No. 2, p. 122.
7 BECKETT, A., BUCKNER, L.: Promoting positive attitudes towards disabled people: Definition of rationale and prospects for anti-disablist education. In *British Journal of Sociology of Education,* 2012, Vol. 33, No. 6, p. 874-890.
8 See also: HOLMES, S.: *Improving the social interactions between students with disabilities and their peers: A comparison of interventions.* [Dissertation Thesis]. Stillwater : Oklahoma State University, 2011.
9 MOORE, D., NETTELBECK, T.: Effects of short-term disability awareness training on attitudes of adolescent schoolboys. In *Journal of Intellectual and Developmental Disability,* 2013, Vol. 38, No. 3, p. 224-230.
10 HARDART, M.: *Social Integration of Disabled Children.* Paper presented at International scientific conference Games For Health Conference 2006. Baltimore, presented on 28th – 29th September 2006.
11 CROCKER, J., MAJOR, B.: Social stigma and self-esteem: The self-protective properties of stigma. In *Psychological Review,* 1989, Vol. 96, No. 4, p. 609-629.
12 SHAPIRO, D., MARTIN, J.: The relationships among sport self-perceptions and social well-being in athletes with physical disabilities. In *Disability and Health Journal,* 2014, Vol. 7, No .1, p. 43-47.
13 For more information, see: GERLING, K. et al.: The Effects of Embodied Persuasive Games on Player Attitudes Toward People Using Wheelchairs. In JONES, M., PALANQUE, P., SCHMIDT, A., GROSSMAN, T. (eds.): *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. New York : ACM, 2014, p. 3413-3422.
14 KITTSON, K.: The effect of video observation on warmth and competence ratings of individuals with a disability. In *Psychology of Sport and Exercise,* 2013, Vol. 14, No. 6, p. 848-850.
15 BRASILE, F.: Wheelchair sports: A new perspective on integration. In *Adapted Physical Activity Quarterly*, 1990, Vol. 7, No. 1, p. 4-10.

Intervention Design

Digital game play can reduce the social stigma of physical disability by challenging players to perform in a domain in which disabled persons excel[16]. The game developed as intervention in this study underwent two distinct design phases, perhaps best termed 'Impaired' and 'Empowered'.

The 'Impaired' Design

The game design process began with meetings of disabled children who are served by NYU Langone Medical Center's Rusk Rehabilitation Center. Their initial design explored the impediments they face shopping in a marginally accessible mall. (Picture 1) The resulting design was a maze-like game in which the player optimizes use of the elevator, ramps and disabled-ready restrooms while avoiding various obstacles and, finally, employing a helper stick or requesting shopkeeper assistance to collect goods from high shelves.



Picture 1: Impairment Design
Source: own processing

While this clearly modeled the everyday experience of the children, it is a game of frustration reduction rather than positive achievement. By asking the player to identify with a constrained and dependent protagonist who suffers in a world of impaired agency, the game design risked evoking pity rather than respect for the avatar and for the disabled children it represents. The child designers also recognized that this game design promised little fun. To cure this, they proposed to add a "bumper-car" play element. Their adult leaders, inexperienced in game design, permitted gratuitous vehicular combat, but they expressed misgivings. They insisted that the players who indulged in bumper-car play would be penalized by score reduction. This example of conflicting incentives was not unique. A rising burden of such dissonant features signalled the need to reconsider the original design. Mistuned game mechanics can be fixed by minor design improvements. Misdirected ones cannot. Much recent literature reexamines the value of disability simulation as a method to raise social esteem. For example, V. Brew-Parrish[17] identified three counterproductive beliefs that able participants can take away the simulation experience: They are lucky not to be disabled. Life is tragic for people who are. Disabled people are especially courageous to live their ordinary lives. More precise warning can be found in reports of *Barriers*, a game-like virtual experience[18] whose impediment-avoidance design closely parallels the 'Impaired' design. It was found to increase awareness without improving attitudes.

16 TREPANIER-STREET, M. et al.: Young Children with and without Disabilities: Perceptions of Peers with Physical Disabilities. In *International Journal of Early Childhood Special Education,* 2011, Vol. 3, No. 2, p. 122.

'Empowered' Design

Experienced game designers reset the game's goals. Rather than seeking to elicit sensitivity, the designers aimed for admiration. They positioned the avatar as an aspirational role model – defined by his skills, strength and courage - not by his mobility limits. They designed a heroic avatar exhibiting masterful performance of sporty wheelchair locomotion, a domain where people experienced with wheelchairs exceed the performance of most neophytes[19]. The project introduced subject matter experts. Wheelchair tennis star, Karin Korb[20] and the staff of parathletic promoter, BlazeSports, helped orient the game design team. At one point, the entire studio – artists, designers and programmers – chased one another in racing wheelchairs through the BlazeSports grounds.

The young people at Rusk quickly adopted the 'Empowered' design. Freed to model a world of athletic challenge rather than one of frustrations, they pushed the design of the avatar, his wheelchair and the play mechanics to create a bold game, free of apologetics. Mediated by the engaged Rusk staff, there was a lively and fruitful collaboration between the professionals and these young first-time game designers. Pete Armstrong is a realtime game. At every moment, players are fully engaged by wheelchair challenges as they enjoy skill acquisition and mastery. "Wheelie Pete" Armstrong is a few years older (15) than the target audience. Permanently confined to the wheelchair, he has thin legs but massive upper body development, emphasized by his tank top and his surname[21]. Pete has the inherent strength, balance and speed to win the game, but cannot employ these until the player develops the requisite skills and invests these skills in him. (Picture 2) A female avatar was also designed but, due to limited resources, not implemented for this study.

The wheelchair model in the game is hand-powered. Its design is liberally extrapolated from specialized sport designs[22] used in parathletic competition, particularly the aggressive variant of wheelchair rugby popularly known as "Murderball"[23]. The player is challenged to propel, steer and brake the wheelchair. The center wheel found on a typical personal computer mouse is used as a direct analog of the wheelchair's large drive wheels.

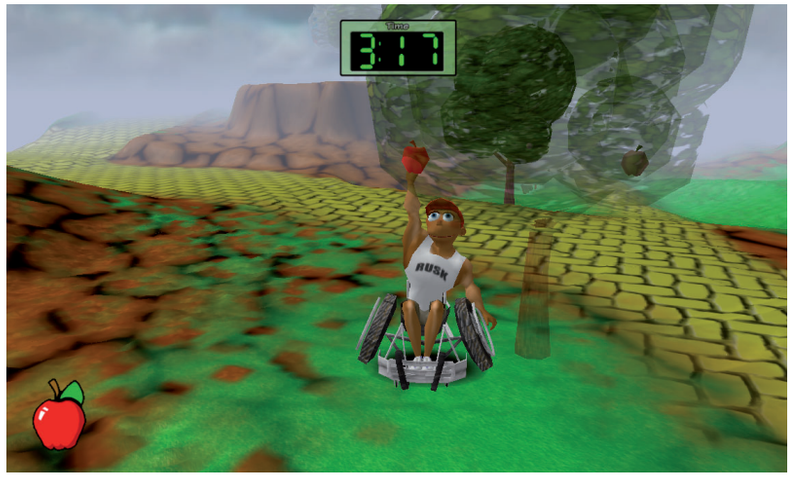
17 BREW-PARRISH, V.: *The wrong message-still.* Released on 8th August 2004. [online]. [2019-03-01]. Available at: <http://www.raggededgemagazine.com/focus/wrongmessage04.html>.
18 PIVIK, J. et al.: Using Virtual Reality to Teach Disability Awareness. In *Journal of Educational Computing Research,* 2002, Vol. 26, No. 2, p. 204-217.
19 BRASILE, F.: Wheelchair sports: A new perspective on integration. In *Adapted Physical Activity Quarterly*, 1990, Vol. 7, No. 1, p. 4-10.
20 DALEY, K.: *Karin Korb – Wheelchair Tennis Champ of the Year.* Released on November 2005. [online]. [2019-03-21]. Available at: <http://www.tennisindustrymag.com/articles/2005/11/karin_korb_wheelchair_tennis_c.html>.
21 STONES, E.: Exploring the intersection of ableism, image-building and hegemonic masculinity in the political communication classroom. In JEFFRESS, M. S. (ed.): *Pedagogy, Disability and Communication: Applying Disability Studies in the Classroom*. London, New York : Routledge, 2017, p. 184.
22 COOPER, R.: Wheelchair racing sports science: A review. In *Journal of Rehabilitation Research and Development*, 1990, Vol. 27, No. 3, p. 296-311.
23 See also: LINDEMANN, K.: Murderball. In *Disability Studies Quarterly,* 2006, Vol. 26, No. 2.

The player rolls the top of the mouse wheel forward or backward to roll the wheelchair forward or back. The left and right mouse buttons represent the left and right wheels. Steering is accomplished not by differential wheel propulsion, but differential braking. The player pivots the chair by pressing the left or right mouse buttons, while driving the chair forward with the wheel. (Future players may use the wheels of two active mice, rolling one in each hand.) The terrain is a hilly apple orchard , made accessible by a network of brick-covered pathways. The paths curve at all times and are rarely level. They present the player with a variety of well-tuned steering challenges. When the wheelchair leaves the pathway, increased rolling resistance arrests the player's progress. Picket fences and steep foothills constrain the player to the game field (Picture 3).

Picture 2: Empowerment Design with Aspirational Avatar and Sporty Wheelchair
Source: own processing

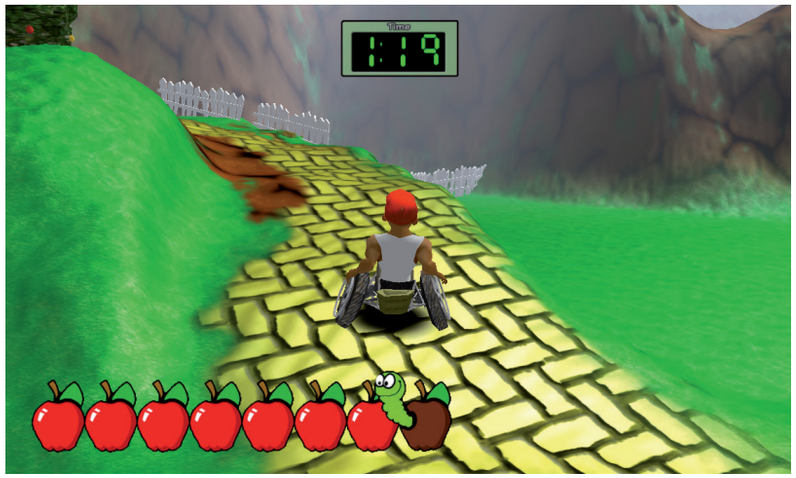
Picture 3: Complex Terrain
Source: own processing

Players cannot climb the steepest pathways directly. They must either build up momentum with a running start or weave from side to side to ascend the hill more gradually. (This dynamic emerged directly from the design team experience in the BlazeSport parking lot.) Hilly terrain also introduces steering challenges. The wheelchair exhibits a natural tendency to turn downhill. As in real life, the player must compensate. The player is challenged to find and collect apples. Seated in the wheelchair, the player can only reach low-hanging fruit. (Picture 4) The player must learn and work around this limitation. The player can also perform better by timing the grab for the apple to fit with the rhythm of pumping the wheelchair wheels.



Picture 4: Reaching for an apple
Source: own processing

The player must be perceptive. Among the red apples on the trees are several wormy brown apples. If added to the basket, the worm devours a few of the red apples that the player has already collected. (Picture 5) There is room on the scorebar for fifteen apples. If the player collects fifteen apples before the time expires, a win sequence is displayed.



Picture 5: A batch of apples infected by a wormy apple
Source: own processing

Participants

Children played the five minute prototype game. Researchers measured their attitudes toward disabled people in pre- and post-intervention testing. Boys and girls (ages 8 to 13) were recruited from two socioeconomically distinct venues in Atlanta, USA. The Paideia School, while committed to diversity, is a private school where professionals send their children. The Harland Boys and Girls Club serves a relatively homogenous population of poor, African-American families with limited educational background. In both cases, the trial was performed during class time. Participation required written parental informed consent and verbal personal assent.

Participation was nearly universal in both classrooms. (Two or three children neglected their parental consent forms and were excluded.) No participants exhibited physical disability. Testing and intervention were administered in a single sitting, so no attrition occurred. Data contamination invalidated the results of 19 participants, but this group was constituted randomly. Those data were discarded, Neither institution had a formal Institutional Review Board, which could be expected to exempt this study from further IRB review. Instead each venue administratively reviewed the study in the light of the Helsinki Declaration[24] and its own ethical commitments. Subjects were not paid. A small contribution was made to the Boys and Girls Club to defray their expenses. After the experiment's conclusion, researchers returned to the venues as invited lecturers. They presented to the children the final results and discussed both the scientific method and the process of game design. At Paideia, 30 subjects were recruited. Two sessions of trials were held in a computer lab. An inadequately-trained researcher corrupted much of the data, and only 11 samples remained usable. In the Boys and Girls Club's well-equipped Intel Computer Clubhouse, 18 trials were performed in three sessions.

Method

The study used the standard instrument "*Attitudes Toward Disabled Persons*" developed by Yuker et al in 1960[26]. With more than fifty years of field research and metastudy analyses[25], the scale (Yuker ATDP-A)[26] provides a useful metric to compare attitudes in this study to those in other contexts and to compare the efficacy of the videogame to alternative interventions. ATDP questions were randomly divided in half: Test A and Test B. Subjects were randomly assigned to one of two pools. One pool used Test A as the pretest and Test B as the post-test. The other pool reversed this. In order to better match the reading level of the young subjects, the language in the ATDP was simplified slightly - sacrificing precision for clarity: 1.) Disabled people should not have to compete for jobs with physically normal people. *Disabled people shouldn't have to compete with everyone else for jobs;* 2.) The driving test given to a disabled person should be more severe than the one given to the nondisabled. *The driving test for disabled people should be harder than the regular test*.

24 For more information, see: *Ethical principles for medical research involving human subjects.* Proceedings from the International scientific conference World Medical Association. 18th General Assembly 1964. Helsinki, presented on June 1964.

25 YUKER, H., BLOCK, J.: *Research with the Attitude Toward Disabled Persons scales (ATDP) 1960-1985.* New York : Hofstra University Press, 1986, p. vii-87.

26 For more information, see: YUKER, H., BLOCK, J., CAMPBELL, W.: *A scale to measure attitudes toward disabled persons.* Albertson, New York : Human Resources Foundation, Division of Abilities, 1960.

These modest modifications proved insufficient. Many children still struggled to read and understand the statements. Children rated the statements on a paper-based questionnaire using a Likert scale. To be clearer to the child, a color-coded six-value Likert choice was employed. (Picture 6) Children were instructed to use the full range of the scale, and results demonstrated that they understood this instruction: Of 1,046 responses, only 367 were at one extreme or the other.

FOR EACH IDEA - PLEASE MARK HOW MUCH YOU AGREE [YES] OR DISAGREE [NO]

103	Disabled people are usually more emotional than other people.	YES					NO
107	Disabled people don't help other people very much.	YES					NO
108	Most normal people wouldn't want to marry a disabled person.	YES					NO
109	Disabled people are as happy and excited as everyone else.	YES					NO

Picture 6: Questionnaire excerpt

Source: own processing

The Boys and Girls Club subjects speak African-American Vernacular English (AAVE). Like many other languages (such as Slovak or Spanish)[27], this popular sociolect employs the grammatical principle of *negative concord*. Multiple negatives in a single statement are a proper and emphatic formation. ("It ain't no thing." "I ain't got no money.")[28] By contrast, in Standard English, double negation renders a positive statement ("The play is not without charm." "I don't actually have *no* money.").[29] The Yuker instrument, like similar instruments, employs complex multiple negation, presumably to distinguish conscientious respondents from thoughtless ones. Multiple negation is found in the formulation of statements ("Most disabled persons are not dissatisfied with themselves.") but more often in negative statements constructed so that positive sentiments are expressed through a negative Likert response. Confronting these, speakers of Standard American English, tuned to negative inversion, struggled (with only moderate success) to register their intent accurately. Researchers noted that the Afro-American children, tuned to negative concord, more often misunderstood the instrument and marked the unintended answer. This was illustrated by Cronbach's alpha, a metric of psychometric consistency. (Table 1) Removing instances of multiple negation changed alpha slightly for speakers of Standard American English (0.74 to 0.77). Alpha changed dramatically for speakers of AAVE (0.19 to 0.33). The large remaining intergroup discrepancy (0.77 vs 0.33) suggest further ethnocentric issues.

27 See also: VAN DER WOUDEN, T., ZWARTS, F.: A semantic analysis of negative concord. In LAHIRI, U., WYNER, A. (eds.): *Proceedings of SALT III.* Ithaca, New York : Cornell University, 1993, p. 202-219.

28 PULLUM, G.: African American Vernacular English is not standard English with mistakes. In WHEELER, R. (ed.)*: The workings of language: From prescriptions to perspectives.* Westport, CT : Praeger, 1999, p. 60-65.

29 See also: PERES, J.: Towards a comprehensive view of negative concord. In JASZCZOLT, K. M., TURNER, K. (eds.): *Meaning Through Language Contrast.* Amsterdam, Philadelphia : John Benjamins Publishing Company, 2003, p. 29-42.

Results

The low power pilot test produced few results with p-values below 0.05. Immediate elevation of the ATDP score between pre and post tests compares well with the results of other interventions. Analysis suggests that efficacy has a negative correlation to habitual digital game play and positive correlations to female gender and to familiarity with disabled individuals.

Table 1: Before and after filtering the questions

	Standard English Speakers		Afro American Vernacular English	
	Pre	Post	Pre	Post
Straight Yuker	0.63	0.84	0.08	0.30
Complex negation removed	0.69	0.84	0.22	0.44

Source: own processing

The aggregate pilot results (Table 2) demonstrated an overall 11% improvement in attitude toward disabled persons after a single gameplay session. Yuker scale means increased from 107 to 119.

Table 2: Summary of results

Class	N	Pretest	Std	Test	Std	Effect
Total	**27**	**107**	1.04	**119**	0.95	**11%**
Female	**14**	**104**	1.12	**129**	0.87	**25%**
Male	**13**	**110**	0.96	**111**	0.96	**1%**
Private School	**9**	**106**	0.85	**114**	0.68	**7%**
Inner City	**18**	**107**	1.14	**122**	1.07	**13%**
Limited Contact	**9**	**123**	1.03	**120**	0.83	**-2%**
Disabled Friends	**8**	**93**	1.08	**103**	0.75	**11%**
Disabled Family	**13**	**101**	1.04	**133**	0.72	**32%**
Play Often	**11**	**105**	1.08	**112**	1.11	**7%**
Play Sometimes	**15**	**112**	0.93	**126**	0.81	**12%**
Play Rarely	**4**	**106**	1.30	**129**	0.64	**21%**

Source: own processing

A pilot ANOVA showed that efficacy was significantly ($0.01<p<0.05$) correlated to personal familiarity with disabled individuals (Chart 1) and inversely to habitual game play (Chart 2). Moderate ($0.05<p<0.10$) correlations were observed with female gender (Chart 3) and with age but the latter is marred by very small samples at some ages. There is little difference between the results observed in private school children and those seen in disadvantaged children. (Chart 4) Analysis could not reliably disambiguate the videogame experience finding from these confounds of gender and age.

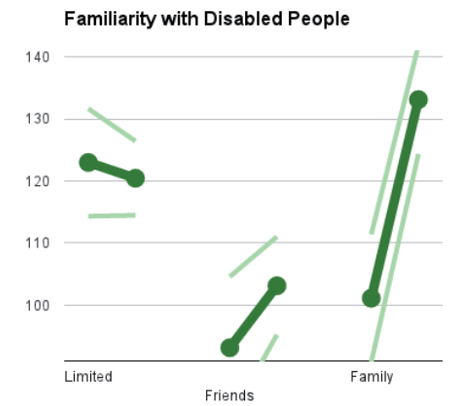


Chart 1: Efficacy by familiarity with disabled people
Source: own processing

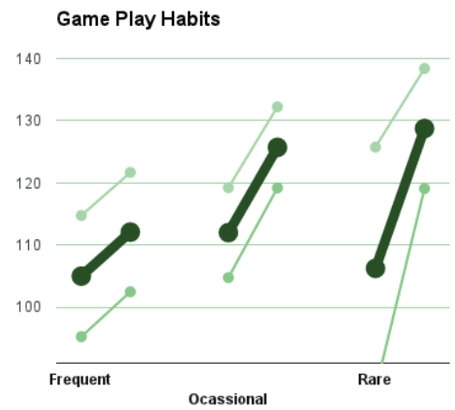


Chart 2: Efficacy by game play frequency
Source: own processing

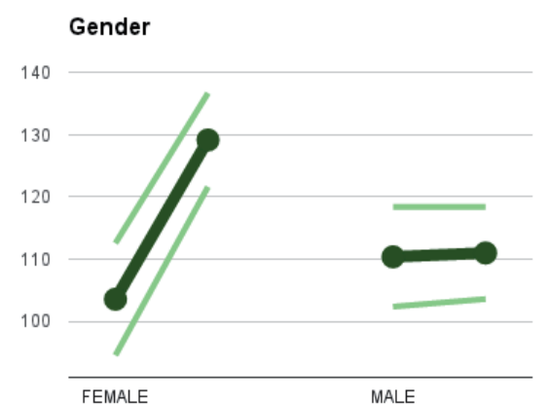


Chart 3: Efficacy by gender
Source: own processing

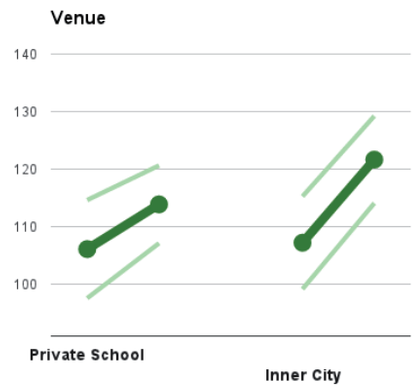


Chart 4: Efficacy by Social Class
Source: own processing

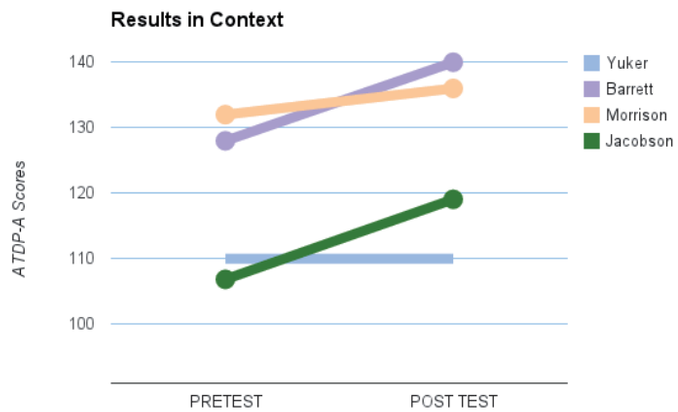


Chart 5: Results in a larger context
Source: own processing

Discussion

These pilot results fit well with results in the reports of other interventions (Chart 5). On the standard scale of 0 to 300, this trial scores approximate those originally recorded by H. Yukere et al[30]. Their immediate improvement (11%) is similar to that reported by K. Barrett and R. Pullo[31] (9%) when measuring the effect of a summer care-giving internship on the attitudes of undergraduate students. I. A. Morrison[32] reported a 3% improvement in attitude among interns. Note that self-selected interns and students began with elevated scores. A counterintuitive result is that children with disabled family members or friends began with far more negative attitudes than those with little exposure to the disabled. Furthermore, it was this class of subjects that had the strongest response to the game. Yuker explains that degree of contact is less predictive than type of contact. Significance metrics show that the steep improvement of those with 'Family' contact results is only suggestive, but the among those with 'Friends' contact data are significant (p-value below 0.05). Children with greater habitual videogame play were less influenced by the moral persuasion of the game than those who play rarely. Yet this response does not result from less engagement from the frequent players. On the contrary, frequent gamers rated Pete Armstrong at 0.36 as "Fun for Middle Schoolers", versus 0.25 for the occasional players. Despite their greater enjoyment, the frequent gamers had only a 7% improvement versus 12% for the occasional players.

Their lower response may be due to their practice of focusing on a game's mechanics rather than its story. Alternatively, less skilled players may have developed a greater sense of empathy because they experienced more difficulty playing the game. Or, as a third alternative, the experienced players might compare the prototype's production values with the high budget titles they ordinarily play, and may accord it less authority.

30 For more information, see: YUKER, H., BLOCK, J., YOUNG, J.: *The Measurement of Attitudes Toward Disabled Persons*. Albertson, New York : Human Resources Center, 1966.
31 BARRETT, K., PULLO, R.: Attitudinal change in undergraduate rehabilitation students as measured by the attitudes toward disabled persons scale. In *Rehabilitation Education*, 1993, Vol. 7, No. 1, p. 120-125.
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Conclusion

The score elevation warrants a higher powered longitudinal study. Significant secondary observations invite explanation, particularly the negative correlation between game play habit and the effectiveness of game-based attitude change. Additionally, analysis suggests an ethnolinguistic bias in the established psychometric instrument. This project's limited resources produced a playable prototype, but were inadequate to conduct sufficiently powerful efficacy testing. Better science requires larger samples and a control group to factor out distortions such as the Hawthorne effect. An improved study would measure reinforcement and retention, exposing subjects to multiple play sessions under longitudinal observation. It would replace the Yuker instrument with one intended for children and suited to diverse populations. A very valuable study would develop two matched alternate interventions, to directly compare the efficacy of 'Impaired' design against that of 'Empowered' design. Despite millennia of lurching human progress, social acceptance of others is not yet in oversupply. Games can help a community develop respect for its outsiders, particularly if the game exposes the outsiders' unique strengths. We hope our efforts and findings encourage further progress from other creative teams.

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