Socially Optimized Learning in Virtual Environments (SOLVE): Developing, Evaluating, and Disseminating A Game HIV Prevention Intervention Nationally Over the Web

*Lynn Carol Miller*

University of Southern California¹

John L. Christensen²  Paul Robert Appleby¹  Stephen John Read¹  Stacy C Marsella¹  Charisse Corsbie-Massay³  Carlos Gustavo Godoy¹  Mei-Si⁴  Janeane Anderson¹  David Jeong¹  and Mina Park¹

University of Connecticut²  Syracuse University³  Rensselaer Polytechnic Institute⁴

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Minority Fellowship Program
HIV Incidence In US Still Highest Among Men Among MSM Among Men

Estimated Incidence of HIV Infection among Adults and Adolescents, by Sex, 2010 — United States

- Females
  - No. = 9,500
  - (8,100–10,900)
  - Female 20%

- Males
  - No. = 38,000
  - (33,400–42,600)
  - Male 80%

Estimated Incidence of HIV Infection among Adults and Adolescents Males, by Transmission Category, 2008-2010 — United States

- Male-to-Male Sexual Contact (MSM)
- Injection Drug Use (IDU)
- MSM/IDU
- Heterosexual Contact

* Indicates significantly different (p<0.05) from the 2008 estimate for the same group.

Evidence intervals reflect random variability affecting model uncertainty but may not reflect del-assumption uncertainty; thus, they should be interpreted with caution.
Incidence Raising Faster Among Youngest MSM

Estimated Incidence of HIV Infection among Men who have Sex with Men, by Age Group, 2008-2010 — United States

*Indicates significantly different (p<0.05) from the 2008 estimate for the same group
Younger MSM may have “tuned out” of traditional HIV Prevention interventions

• As CDC noted: *Need more engaging interventions* (e.g., interactive media, games).

• *Traditional interventions* focus on changing skills and *deliberative* cognitive processes (e.g., beliefs, norms, intentions, self-efficacy); *neglect affect* that may “in the moment” lead to more *automatic* risk-taking despite one’s best intentions.
Based on a Neuroscience Model of Decision-Making

Adapted from Figure 2, Bechara, A., Damasio, H., Tranel, D., & Damasio, A. (1997) (See also Damasio, 1994).
Like Many Health Theories Cognitions/Skills Matter

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Like Many Health Theories Cognitions/Skills Matter

So the intervention goals would be to change:
- problematic cognitions (knowledge, beliefs) about the self, others, HIV/AIDS, or the current situation
- enhance negotiation and condom use skills
- better link current behaviors with future outcomes and consequences.

Adapted from Figure 2, Bechara, A., Damasio, H., Tranel, D., & Damasio, A. (1997) (See also Damasio, 1994).
Unlike Many Health Theories Emotion Matters Too

Virtual or Real Life Decision

Affect Bias Decisions (based on prior emotional experience of comparable real– and/or virtual situations) can automatically guide behavior

Overt Recall Of Facts

Options for Decisions (given mental model of self, other, and the current situation)

Representation of Future Outcomes

Skills (Procedural Knowledge)

Real-Life Behavior

Real-Life Environmental Constraints/Obstacles Not Included Virtually

Adapted from Figure 2, Bechara, A., Damasio, H., Tranel, D., & Damasio, A. (1997) (See also Damasio, 1994).
**Unique Goal: Create Sex Positive Intervention**

- **Virtual and Real Situation**
  - Overt Recall Of Facts
    - Options for Decisions (given mental model of self, other, and the current situation)
    - Representation of Future Outcomes
  - Reasoning Strategies
  - Virtual or Real Life Decision
  - Skills (Procedural Knowledge)
  - Real-Life Behavior
  - Real-Life Environmental Constraints/Obstacles Not Included Virtually

Create similar contextual/emotional challenges as in real-life
Enhance:
- Self-regulation
- Shame Reduction

Adapted from Figure 2, Bechara, A., Damasio, H., Tranel, D., & Damasio, A. (1997) (See also Damasio, 1994).
Why Unaddressed Shame Might Matter

• Men who have sex with men (MSM) often face *socially sanctioned disapproval of sexual deviance* from the heterosexual “normal.”

• Such *sexual stigma* can be internalized producing a painful affective state (i.e., *shame*).

• Although shame (e.g., due to addiction) can predict risk-taking (e.g., alcohol abuse), *sexual shame’s link to sexual risk-taking is unclear*.

• *Sexual shame likely to be activated when MSM desire another man (but beliefs tell them that they shouldn’t) – may often be immediately before deciding/not to use a condom.*

• Socially Optimized Learning in Virtual Environments (SOLVE) is an interactive game that was designed to reduce MSM’s sexual shame.
In Earlier Work, We Developed Interactive Videos (IAV) for Latino, White, and Black Young (18-30) MSM

MSM assume the role of a character on a virtual date with an attractive other

MAKE Contextualized VIRTUAL DECISIONS That Guided How the Narrative Proceeded

NIAID GRANT #: 5R01A1052756-05
SOLVE Interactive Video

Ethnically matched Virtual Guides and Models (instead of face-to-face ones) in 3 separately developed IAV for each of three groups of MSM

Guides “Pop up” and guide user into safer choices when user makes a risky choice...
NIAID Results- Significant UAI ACT REDUCTION over 3-Months in IAV vs. Control, Only 18-24 Year Old MSM

A significant between-subjects interaction between age and condition, $F(1, 346) = 4.4$, $p = .04$. Follow-up tests revealed among younger MSM significant UAI reduction compared to control; not the case for older MSM. No ethnicity effects.
What Significantly Changed Pre-Post Intervention in IAV vs. Control?

Cognitions/Skills

• *HIV Risk Reduction Behavioral Intentions* (modified from Kelly and Kalichman, 1998)
• *Supplemental Behavioral Intentions Scale*
• *Methamphetamine beliefs and intentions*
• *HIV Beliefs and Knowledge*
• *Self-efficacy*

But, change in these cognitions (pre to post) did not predict change in UAI over time.

Affect

**MSM’s Reported Shame Reduction Was Greater in IAV**

Furthermore, Change in Shame predicts 3-month change in receptive UAI for Younger MSM in IAV experimental ($r_s = .22, p < .05$) but not in control.
SOLVE Findings Promising But...
Difficult to Migrate IAV Technology to the Web for National Dissemination...

So, with an NIMH grant, we Developed a SOLVE Game using UNITY – a game platform for cross-platform flexibility (can work with a variety of laptops, smartphones, tablets, etc.)
What Does SOLVE Game DO?
1. Immerses MSM in virtual world simulating virtual date and many common challenges to safer sex where MSM must make decisions for their avatar as in real-life that affect how the action proceeds.
What Does SOLVE Game DO?

USER CREATES OWN CHARACTER, and makes a series of choices in interacting with potential partners that affect how the action proceeds.

USED REPRESENTATIVE DESIGN APPROACH: The actions and scenarios are designed to be representative of real life challenges that are emotionally engaging (formative research).

MSM Can Customize Self Character

• Skin Color
• Eye Color
• Hair Color
• Clothing Choices
In SOLVE -- Social Guides are one tool for promoting behavior change

In SOLVE-IAV
Guides/Mentors

In SOLVE-IT
• *Virtual Future Self (VFS) — aged version of player’s self*
• Other Research (on retirement planning) suggests user will modify behavior more if a Future (Aged) Self is in the Game
Virtual Future Self (VFS)

Acts as each MSM’s Personalized Guide
Scaffolding Changes in Cognitions, Skills, and Emotional Self-regulation
How do we design SOLVE to reduce shame? Enhance self-regulation?

• Careful design of characters, dialogue, storylines in the game to create a “sex positive intervention”

For example, player’s avatar consistently models positive self-appraisals and comfort with his sexuality/desires.

• With our virtual future self as a “good parent” we encourage each MSM to acknowledge his emotions and desires as normal for him.

To do this we use a Self-regulatory Narrative Circuit similar to the elements developmental psychologists point out that skilled parents often use to enhance self-regulation.
In SOLVE
Self-Regulatory Narrative Circuit involves an:

ICAP Process

Generate Possible Solutions; Develop Plans to Optimize Goals, Taking Resources into Account

Clarify Interpersonal Goals for Self and Other

Interpret and Make Inferences for Self & Other Affective Cues (what they may mean—cause, effect, intent)

Read Affective Cues
- Self - Other

Make a Decision Possible Decision-Making Process

Act on Decision Enact Behavior

Read, Miller, Appleby, Nwosu, Reynaldo, Lauren, & Putcha (2006)
In SOLVE
Self-Regulatory Narrative Circuit involves an:

ICAP Process

- **Interrupt (I)** an automatic risky virtual choice and **challenge it** because it’s risky

Read, Miller, Appleby, Nwosu, Reynaldo, Lauren, & Putcha (2006)
In SOLVE
Self-Regulatory Narrative Circuit involves an:

- Challenge (C) Beliefs/Attitudes

Read, Miller, Appleby, Nwosu, Reynaldo, Lauren, & Putcha (2006)
In SOLVE
Self-Regulatory Narrative Circuit involves an:

- Acknowledge, Accept, & Share (A):
  For example, MSM’s attraction to this man and his desires (sex positive intervention; goal to reduce shame)

Read, Miller, Appleby, Nwosu, Reynaldo, Lauren, & Putcha (2006)
In SOLVE
Self-Regulatory Narrative Circuit involves an:

ICAP Process

- Acknowledge (A) & clarify multiple goals (e.g., intimacy desires; desire to avoid HIV).

Read, Miller, Appleby, Nwosu, Reynaldo, Lauren, & Putcha (2006)
In SOLVE

Self-Regulatory Narrative Circuit involves an ICAP Process

**Provide (P):**

*A means* to deal with these various goals/motives and emotions with more positive outcomes (e.g., have anal sex with a condom)

Read, Miller, Appleby, Nwosu, Reynaldo, Lauren, & Putcha (2006)
In SOLVE
Self-Regulatory Narrative Circuit

ICAP Process

- Generate Possible Solutions; Develop Plans to Optimize Goals, Taking Resources into Account
- Clarify Interpersonal Goals for Self and Other
- Interpret and Make Inferences for Self & Other Affective Cues (what they may mean — cause, effect, intent)
- Read Affective Cues -Self -Other
- Make a Decision Possible Decision-Making Process
- Act on Decision Enact Behavior

Then User has a 2nd Chance Choice To be Risky or Safe
All choices recorded

Read, Miller, Appleby, Nwosu, Reynaldo, Lauren, & Putcha (2006)
SOLVE promote changes in cognitions and emotions in many ways including using the VFS to:

- interrupt risky choices
- offer advice (e.g., to remember to take condoms on a date)
- at end of date VFS guides recap risky choices and illustrate/model what user could have done otherwise to have fun but still stay safe. Let’s illustrate this last use of different VFS clips at the end depending upon the user’s choices in SOLVE.

Virtual Future Self (VFS) Acts as MSM’s Guide Scaffolding Changes in Cognitions, Skills (Self-character Aged)
OVERVIEW OF GAME

Post-Baseline Measures

1. Customize Character
2. Hear about and Get Ready for Date
3. Meet VFS
4. Decide to/not Take condoms
5. Level 1: Party at Friend’s House
6. 
7. Level 2: Goes to Bar/Club (Harder to achieve; partner more difficult)
8. 

Goal of Game: Meet a guy, go home with him, negotiate safer sex

• VFS Guide
Interrupts Risky Choices
With an ICAP (Interrupt-Challenge-Acknowledge-Provide Messages Based on Message Framing Pilot Work)
Evaluating Game: National Recruitment & Data Collection in a Randomized Controlled Trial On-line

- Advertisements: Clickable Banner Ads on Targeted Population Frequented Websites & Other Sites (e.g., Craigslist)

- Incentives: lottery drawing at baseline with 1:40 chance of $100 gift card
  - 3-month, MSM offered $25 gift card
Eligible Participants:

- HIV negative
- Self-identified African-American, Latino, or White MSM
- 18 to 24 years of age
- Had had UAI with a non-primary/casual partner in the past 3 months
Methods: National Recruitment and Data Collection On-line

- **Advertisements:** Clickable Banner Ads on Targeted Population Frequent Websites & Other Sites (e.g., Craigslist)
- **Incentives:**
  - Lottery drawing at baseline with 1:40 chance of $100 gift card
  - 3-month, MSM offered $25 gift card

**Screener:** Eligible MSM Randomized into Intervention or Control

- **Baseline Measures** (including UAI, Shame)

- **SOLVE Intervention Game OR Wait List Control (WLC)**

- **Immediate Post-Intervention Measures** (e.g., shame)

- **3-Month Follow-up Measures** (e.g., UAI)
Methods: National Recruitment and Data Collection On-line

- Advertisements: Clickable Banner Ads on Targeted Population Frequented Websites & Other Sites (e.g., Craigslist)
- Incentives: Lottery drawing at baseline with 1:40 chance of $100 gift card
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Analysis:
Data from 921 MSM at Session I (484 WLC; 437 SOLVE)
Missing Data Multiply Imputed

Session II (3-month follow-up)
69% Retention

Screeners: Eligible MSM Randomized into Intervention or Control
Baseline Measures (including UAI, Shame)
SOLVE Intervention Game OR Wait List Control (WLC)
Immediate Post-Intervention Measures (e.g., shame)
3-Month Follow-up Measures (e.g., UAI)
Results by Hypothesis

$H_1$: MSM’s reported past unprotected anal intercourse (UAI) is related to shame.

✓ $r_s = .21$, $p < .001$, 95% CI [.15-.27].
✓ H₂: MSM’s exposed to SOLVE would show more shame reduction (from baseline to immediate post-intervention) than MSM in a wait-list control (WLC) condition
Results by Hypothesis

✓ H₃: Shame reduction, due to an intervention, is predictive of UAI reduction over 3 months.

We used a bootstrapping approach to assess the effect of condition on UAI change indirectly through shame change.

As predicted, the indirect effect was negative and significantly different from zero. Participants in SOLVE treatment condition reported greater reduction in shame, which in turn influenced reduction in UAI at 3 month follow-up.
SOLVE is the first intervention to:

(1) Significantly reduce shame for MSM

(2) Demonstrate that shame-reduction due to an intervention, is predictive of risk (UAI) reduction over time

SOLVE demonstrates the promise of developing, testing, and rapidly disseminating mobile technologies for changing risky sexual decision-making for MSM Nationally

These findings recently published in JIAS
Future Directions

1. Still Analyzing Data (now 6 month data as well)...

2. Other work using game in scanner to examine differences in neural patterns while playing the game comparing different high and low risk groups of MSM
User in fMRI scanner playing game (examining brain patterns for high vs. lower risk MSM)

Simultaneously Modeling Decision-Making of User using our Biologically-Inspired Computational Model of Personality

THANK YOU!