



## ORIGINAL ARTICLE

# The use of partner-seeking computer-mediated communication applications by young men that have sex with men (YMSM): uncovering human-computer interaction (HCI) design opportunities in HIV prevention

Woodrow W. Winchester III<sup>1</sup>,  
Troy D. Abel<sup>2</sup> and  
Jose Bauermeister<sup>3</sup>

<sup>1</sup>Grado Department of Industrial and Systems Engineering, Center for Human-Computer Interaction, Virginia Tech, Blacksburg, Virginia, U.S.A.; <sup>2</sup>Eye Tracking & Usability Testing Lab (E-TUT), Institute for Creativity, Arts, and Technology, Department of Visual Communication and Design, Virginia Tech, Blacksburg, Virginia, U.S.A.; <sup>3</sup>SexLab, University of Michigan, Michigan, U.S.A.

Correspondence: Troy D. Abel, Virginia Tech, 201 Draper Road, Blacksburg, VA 24061, U.S.A.  
E-mail: tabel@vt.edu

## Abstract

HIV/AIDS incidence among young men who have sex with men (YMSM), both in the United States and globally, remains a public health priority. Using Activity Theory as a framework, and YMSM as a target population, we examine the intricate three-way relationship between safer sex (i.e., condom) negotiation, HIV status disclosure behaviors, and the use of computer-mediated communication applications as a means of seeking sexual partners, particularly casual partners (e.g., one night stands, hookups). We offer a human-computer interaction (HCI) research framework that could uncover more impactful design opportunities for HIV prevention.

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## Introduction

HIV/AIDS incidence among young men who have sex with men (YMSM), both in the United States and globally, remains a public health priority (Control CfD, 2012). Behavioral strategies to reduce the risk of infection require researchers and practitioners alike to continually re-examine prevention modalities and behavior change strategies (Grossman *et al*, 2011). Web and mobile-based platforms are promising prevention and research modalities given their appeal among youth, suitability for advancing research focused on contextualizing HIV/AIDS risk, and its unique capability to diffuse HIV/AIDS prevention programs to large numbers of youth residing in numerous geographic locations (Mustanski, 2001; Pequegnat *et al*, 2007). While promising, these partner (sexual)-seeking computer-mediated communication (CMC) platforms (i.e., CMC applications) have also enabled the development of sexual and romantic relationships and created opportunities for HIV transmission by virtue of these platforms' accessibility, affordability, and anonymity when seeking sexual partners (Garofalo *et al*, 2007; Bauermeister *et al*, 2011). For example, the prominence and rise in the popularity and adoption of CMC applications for casual sexual partner seeking, inclusive of location-based social networking (LBSN) applications such as Grindr by YMSM has been meteoric (Winchester, 2010). Although the

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public health interest in this trend is growing, public health practitioners will require a greater empirical understanding of CMC use in order to develop and implement innovative behavioral-based HIV prevention strategies (i.e., interventions) (Winchester, 2009).

Mounting evidence suggests that online partner-seeking *per se* is not a correlate of HIV risk. Mustanski (2007), for example, noted that YMSM did not report greater sexual risk with partners met online than with partners met offline when followed over time using diary data. In a cross-sectional analysis, Hooper *et al* (2008) compared the HIV risk of men who had sought partners exclusively online, exclusively offline, or both online and offline. Men who met sexual partners online and offline were more likely to report greater HIV risk behaviors than men who had reported meeting partners exclusively online or offline, respectively. These findings suggest that men's motivations to seek partners online (e.g., casual sex *vs* romantic interest), as well as the interactions that occur during these online exchanges (e.g., condom negotiation or HIV status disclosure), may better explain the relationship between CMC use and HIV risk. Consequently, as the public health community strives to reduce HIV infection rates, it remains paramount that they understand how real-time CMC technologies are influencing sexual negotiations and HIV disclosure behaviors (Halkitis, 2010). As a contribution to this literature, we present a human-computer interaction (HCI) research framework that will address this need.

In this paper, we hypothesize that the use of Activity Theory offers a holistic understanding of safer sex negotiations via CMC applications. The rationale for this hypothesis is that Activity Theory situates the activity (i.e., safer sex negotiations via CMC applications) within its greater environmental context (i.e., sexual partner seeking). Activity Theory, advanced by Engeström (1987), has a rich history in HCI. At its core, Activity Theory postulates that tools shape the user's interactivity with an object (Abel, 2009, 2010). For example, Activity Theory would suggest that YMSM (i.e., the users) will be at greater risk for HIV exposure through online casual partner-seeking behaviors if the design of these web and phone applications (i.e., the tools) limit safer sex interactions (e.g., HIV status disclosure or condom negotiation). As such, it is our underlying supposition that these safer sex negotiations do not occur because the design affordances of these partner-seeking applications are not sufficiently (a) robust as channels for safer sex negotiation or (b) responsive in supporting the nuanced nature of safer sex negotiations. Thus, through the lens of HIV prevention, these design *affordances* could be rendering partner-seeking applications deficient. Consequently, it is imperative that researchers identify the challenges and/or breakdowns in sexual negotiations, in order to support and inform the design of more effective behavioral-based HIV prevention interventions (both online and offline) for YMSM, as highlighted in Winchester (2009) and summarized in Figure 1.

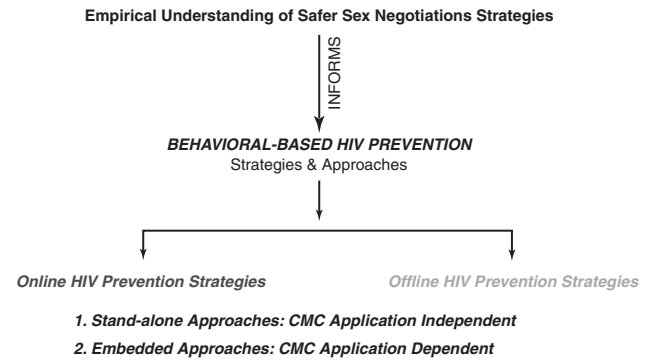


Figure 1 Research framework.

### The problem: 'hooking up' or 'safely hooking up'

The evidence suggests that online negotiations leading to safer sex – as afforded by these CMC technologies in casual sexual partner seeking – may be supplanting face-to-face discussions around HIV status (Davis *et al*, 2006). Some researchers, for example, have acknowledged that men who have sex with men (MSM), in general, may select sexual partners and inform their condom use decisions based on the HIV status posted in a prospective partners' profile, irrespective of whether that profile is accurate or up-to-date (Horvath *et al*, 2010). From a prevention perspective, the tendency of YMSM to rely on CMC as a means of communication with potential partners about HIV status disclosure and safer sex, whether explicitly or implicitly, is of serious concern.

Many of the popular partner-seeking applications afford users the ability to explicitly articulate their safer sex intentions within their profile. For example, <http://www.adam4adam.com>, a popular partner-seeking CMC application, allows users (a) the option to disclose their HIV status, using a drop down of menu options including 'don't know', 'negative', or 'positive', and (b) denote their sexual behaviors, using a drop down menu of options that includes 'safe sex only' or 'anything goes'. While these affordances can be viewed as empowering the users to enact their sexual agency when seeking sexual partners, the design decisions could offer unintended consequences with regard to HIV transmission, particularly if users rely on this information as the sole source/mechanism when making sexual decisions (e.g., foregoing condoms). For example, given that approximately one in every four HIV cases in the United States do not know their status (Marks *et al*, 2005, 2006), users who engage in 'serosorting', the selection of sexual partners who have the same HIV status for unprotected anal sex (Osmond *et al*, 2007), as a behavioral HIV prevention strategy, may in fact be increasing their potential for HIV infection. Further, even when an individual is tested, window period challenges with HIV testing exist. It takes 2–8 weeks for a person newly infected with HIV to make detectable antibodies. With this in mind, within the context of the real-time nature of CMC applications, individuals may erroneously believe themselves

to be negative, code themselves as 'HIV negative' in their profile, and engage in unprotected sex during the acute infection period, the most infectious period of HIV transmission (Chiasson *et al*, 2006).

Other partner-seeking CMC applications do not afford users the ability to be explicit about their safer sex intentions. Craigslist.com, another popular platform that is often used by individuals seeking casual sexual partners, for example, leaves content creation solely up to the user's discretion, which may or may not include details about their safer sex intentions. Davis *et al*, (2006), for example, noted that users employ cues or signals to convey their safer sex intentions. Similarly, Chiasson *et al* (2006) noted that it is common for some MSM to use verbiage such as 'clean and safe, UB2' within their profiles to denote that they are HIV negative and engage only in *safer* sex behaviors/activities. Employing these types of implicit or passive strategies could be problematic from a safer sex negotiations perspective as the interpretation of the language may not be as intended (Lombardo, 2009). In a recent qualitative paper, Eisenberg *et al* (2011) found that YMSM often attributed their unsafe sexual acts to communication breakdowns or assumptions about their partners or the sexual encounter.

Taken together, these findings underscore the importance of considering the design affordances of partner-seeking CMC applications in HIV prevention efforts. It is the author's belief that a design tension exists between the CMC designers and/or developers of these applications and the public health community (Rosenberger *et al*, 2011). The overall design intent, and the analogous design affordances, of partner-seeking CMC applications are to facilitate a connection that could lead to a sexual encounter (i.e., the goal, explicitly or implicitly, of the application). This design perspective places a successful sexual encounter as the primary outcome; leaving safer sex negotiations – *the public health imperative* – as a user's decision after a sexual connection is made. Undoubtedly, creating applications that promote partner-seeking behaviors and simultaneously promote sexual safety will be challenging, but may be possible if design affordances are carefully considered. Consequently, it is imperative that HCI researchers and practitioners, CMC designers and/or developers, and public health experts collaborate to develop design affordances within partner-seeking applications that remain appealing to the user (e.g., application facilitates sexual encounters), while promoting safer sex negotiations (e.g., provide sufficient sexual health information in profiles for users to make informed decisions). Using Activity Theory, we offer a research framework to realize this notion.

### **Theory – using Activity Theory to garner a more holistic understanding of design affordances of partner-seeking CMC applications**

The use of Activity Theory aligns well with contemporary HIV prevention discourse and offers more systemic approaches that contribute to an understanding of safer sex

behaviors in context (Harper, 2007). CMC applications have changed how individuals seek sexual partners, how they relate to each other, and how proposed norms and communities are constructed within their environments (Rosser *et al*, 2011). As a result, CMC partner-seeking applications cannot be simply viewed as a tool; rather, they must be examined and understood as systems situated within an environmental context, each with its unique interfaces and norms regarding sexual behavior and safer sex enactment. To support our exploration of Activity Theory as an innovative research framework, we employ the six stage model offered by Mwanza (2001).

- Stage 1. Model the situation being examined
- Stage 2. Produce an Activity System of the situation
- Stage 3. Decompose the Activity System
- Stage 4. Generate Research Questions
- Stage 5. Conduct a Detailed Investigation
- Stage 6. Interpret Findings

Since the goal of this particular effort is to offer the HCI and public health communities a research framework, the focus of this manuscript will be through Stage 4.

Stage 1: Model the situation (see Figure 2).

Stage 2: Activity of situation (The Activity Triangle Model).

1. *The Activity* (What is the activity or behavior under consideration?): The activity of interest is the safer sex negotiation activities that occur in the context of casual sexual partner seeking (i.e., hooking-up) via CMC technologies.
2. *The Object or Objective* of the activity (Why the activity is taking place?): The activity is taking place in an effort to convey and enact safer sex intentions in the context of a casual sexual encounter initiated via the use of CMC technologies.
3. *The Subjects in this Activity* (Who is involved in this activity?): The subjects involved are YMSM and their casual sexual partners.
4. *Tools mediating the Activity* (By what means are the subjects carrying out this activity?): The subjects are carrying out this activity via a CMC application, for example a LBSN application such as Grindr.
5. *Rules and regulations* (Do specific rules and regulations mediating the activity exist?): Differences in safer sex negotiations and HIV disclosure behaviors, inclusive of norms, rules, and standards among the subjects, can include (but are not limited to) such factors as (Abel, 2009, 2010):
  - (a) *Race/Ethnicity*: Wei *et al* (2011) found significant racial/ethnic differences in HIV disclosure behaviors.
  - (b) *Geographic location* (e.g., rural or urban areas): Kakietek *et al* (2011) found that in rural areas using the Internet to meet sex partners is a marker for men who are more likely to engage in risky sex.

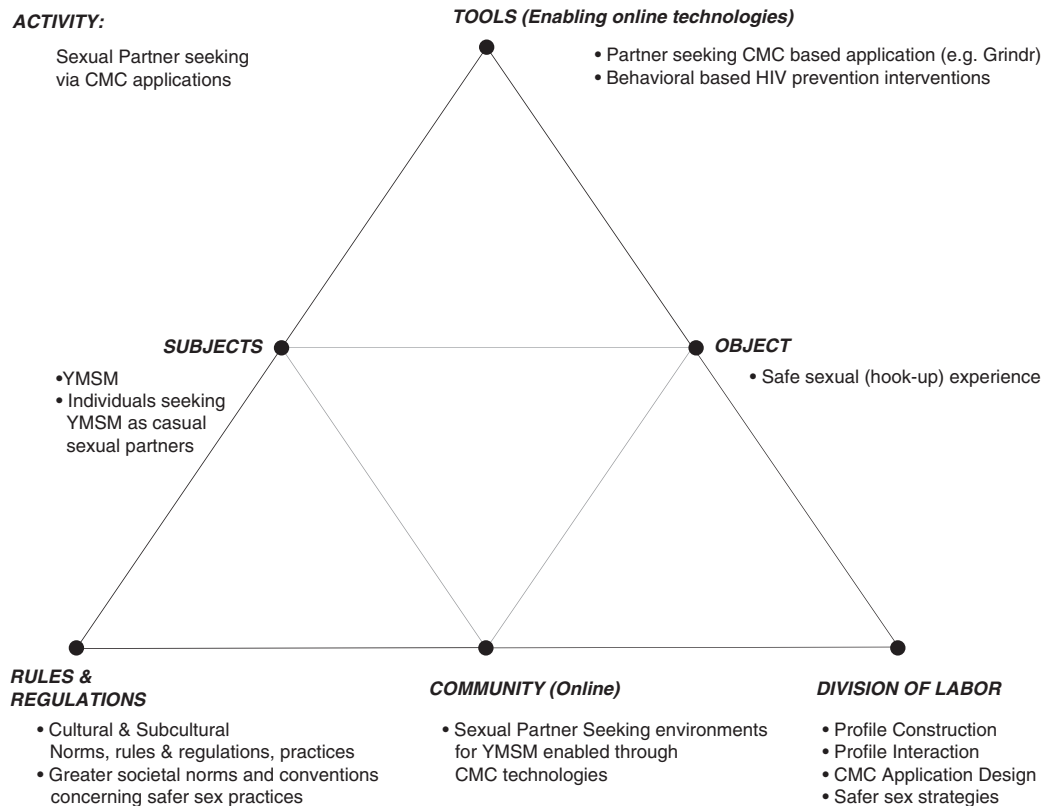


Figure 2 The activity triangle model.

(c) *Subculture*: Prestage *et al* (2009) found that a higher level of risk exists among men engaging in group sex.

6. *The Community*: The community is the online casual sex partner-seeking environment for YMSM enabled through CMC technologies.

7. *Division of Labor*: Three contributing parties function as ‘design’ stakeholders within the context of CMC application use.

(a) The subjects, YMSM and those seeking YMSM as casual sexual partners, as they are responsible for both profile construction and interpretation (interaction).

(b) The application designer(s) and/or developer(s) (application owners) are responsible for determining the affordances of these applications.

(c) The public health community insures safer sex behaviors and intentions are clearly communicated as a precursor to facilitating actual behavior.

Stage 3: Decomposing the Situation’s Activity System: Offering a Research Framework.

The intent of Stage 3 is to decompose the activity triangle model into several three-prong relationships in an effort to begin generating Research Questions that offer requisite understanding of how safer sex negotiations

occur in this emerging arena. Summaries of the resulting Research Questions are presented in Table 1.

**[Subject–Tools–Object]: What tools do the subjects use to achieve their objective and how?**

*How do YMSM, and those seeking YMSM as casual sexual partners, use partner-seeking CMC technologies and availed behavioral-based HIV prevention in supporting safer sex negotiations?*

This question begins to explore the ‘suitability’ of partner-seeking CMC applications in supporting safer sex negotiations. Specifically, this question spurs explorations of how technology affordances are used and/or appropriated in supporting safer sex negotiations. As discussed earlier, many of these applications afford the user the opportunity to more explicitly code their safer sex intentions; however, anecdotal evidence suggests that often more ‘passive’ means (e.g., imagery, code words, phrasing) are used to both represent and interpret the intention. With the goal of informing the design of more effective HIV interventions a more holistic understanding of these behaviors is critical as intentions may not be interpreted as intended (Eisenberg *et al*, 2011). Moreover, this question begins to explore how the subjects use availed behavioral interventions for HIV prevention (on and/or offline) in this more real-time context.

**Table 1 Relationships among elements in the Activity Theory Triangle specific to CMC Applications.**

<i>Sub-activity triangle</i>	<i>Research Question(s)</i>	<i>Research Question operationalized</i>
Subject–Tool–Object	What Tools do the Subjects use to achieve their Objective and how?	(R1) How do YMSM and those seeking YMSM as casual sexual partners use CMC technologies and availed behavioral-based HIV prevention interventions (tools and/or technologies) in supporting safer sex negotiations?
Subject–Rules–Object	What Rules affect the way the Subjects achieve the Objective and how?	(R2) What are the governing rules/conventions (inclusive and analogous values and norms) that influence safer sex negotiations in the context of use of CMC technologies in seeking YMSM as casual sexual partners?
Subject–Division of Labor–Object	How does the Division of Labor influence the way the Subjects satisfy their Objective?	(R3) How do the design stakeholders (i.e., application designers and developers, public health community, and the user (as often a content and design stakeholder)) influence through their design activities safer sexual outcomes?
Community–Tool–Object	How do the Tools in use affect the way the Community achieves the Objective?	(R4) How does the use of CMC applications influence community practices in facilitating safer sex outcomes?
Return Community–Rules–Object	What Rules affect the way the Community satisfies their Objective and how?	(R5) What rules affect the way the community practices influence the negotiation process in facilitating safer outcomes in this context?
Community–Division of Labor–Object	How does the Division of Labor affect the way the Community achieves the Objective?	(R6) How do the design stakeholders influence the means by which community practices facilitate safer outcomes?

**[Subject–Rules–Object]: What rules affect the way the subjects achieve the objective and how?**

*What are the governing rules/conventions (inclusive and analogous values and norms) that influence safer sex negotiations in partner-seeking CMC?*

These rules and conventions represent those implemented by the subjects, and often differ by sub cultural, ethnic/racial, and/or geographic perspectives, within the context of conveying and interpreting safer sex intentions. This question also approaches the exploration of personal values and how those values inform design. This will become increasingly important as the stakeholders enrich their understanding of safer sex negotiation behaviors in greater context.

**[Subject–Division of Labor–Object]: How does the division of labor influence the way the subjects satisfy their objective?**

*How do the stakeholders (i.e., application designers and developers, public health community, and the user (the subjects)) influence through their design activities, safer sexual outcomes?*

This question begins to explore the influence of the application stakeholders have on safer sex negotiations. We offer that there are three primary stakeholders: the designer/developer/owner of the application, the public health community, and the YMSM as profile designer (user of the application). From an application design/development/owner perspective, a point of interest is how these application affordances (e.g., banner ads, images, site architecture) influence negotiations, especially in a real-time sense. From a profile design (user construction) perspective, one must ask what affordances (e.g., elements

and/or attributes) the site offers and how they used and/or appropriated to convey and interpret safer sex intentions.

**[Community–Tool–Object]: How do the Tools affect the way the Community achieves the Objective?**

*How do partner-seeking CMC applications influence community practices in facilitating safer sex outcomes?*

This Research Question hopes to garner an understanding of how the applications used by YMSM are shaping (i.e., evolving) community practices surrounding safer sex negotiations. As discussed earlier, rules, norms, and conventions exist, which support safer sex negotiations and which are now being translated into the afforded language and/or structure of partner-seeking CMC applications. Moreover, this question attempts to discover how this translation is stimulating evolution of the new rules, standards, and/or norms outside the context of use of partner-seeking CMC applications.

**[Community–Rules–Object]: What Rules affect the way the Community satisfies their Objective and how?**

*What rules affect community practices and influence the negotiation process in facilitating safer outcomes?*

Also, underexplored in the literature are these community evolved rules and conventions, including the analogous values and norms that drive negotiation behaviors. As previously discussed, the subjects most likely are employing rules and conventions from their differing viewpoints. This question, however, begins to explore whether more community-specific practices in partner-seeking CMC use (e.g., either overall, certain classes/types, or individual applications) have evolved and are being used in supporting safer sex negotiation behaviors. This area represents an

additional layer of relevant information by garnering a more holistic understanding of this phenomenon that ultimately will inform the design of HIV prevention interventions.

**[Community–Division of Labor–Object]: How does the Division of Labor affect the way the Community achieves the Objective?**

*How do the design stakeholders influence the process by which community practices facilitate safer outcomes?*

This question begins to examine how the design activities of the relevant stakeholders impact the community of partner-seeking CMC technologies users. For example, how have the behaviors of the site designers, the public health community, and YMSM developed and evolved safer sex negotiations within the CMC context? This provides insights into the ongoing evolution of community practices within the context.

As detailed in the above table, a rich test bed of HCI related questions (R1–R6) emerge. Answering these questions will provide insight into understanding and describing the reality of decision making within these real-time contexts of use. As these questions are answered, opportunities to more effectively engage HCI design in HIV prevention should unfold.

**Results – applying the research framework: a case study in the use of the theory of planned behavior (TPB) in informing intervention design**

The presented framework should uncover design opportunities for HIV prevention among YMSM. As a demonstration, we offer a case study that illustrates how the empirical understanding garnered through the answering of the derived Research Questions could inform more impactful behavioral model-based HIV prevention designs. Figure 3 offers an HIV/AIDS risk-based conceptual model based on the TPB, one of the leading behavior change theories in HIV/AIDS research given its adaptability across populations,

its use of mixed-method strategies to identify and measure the theory’s constructs, and its application in health communication research (Fishbein, 1995; Fishbein & Yzer, 2003; Fishbein & Cappella, 2006; Pequegnat *et al*, 2007).

At its core, the TPB notes that the best predictor of actual behavior is the individual’s intention to engage in the behavior. Behavioral intention, in turn, is predicted by (a) an individual’s attitudes toward the behavior, (b) the subjective norms ascribed to said behavior, and (c) the perceived behavioral control (i.e., self-efficacy to carry out the behavior successfully in a specific context). Kok *et al* (2007) found that these TPB constructs accounted for 55% of the variance in the intention to use condoms with online partners in a sample of MSM in the Netherlands. While the model details the constructs that substantiate behavioral intention, this theoretical model fails to inform how the understanding of the use of CMC applications, as afforded and appropriated through their design could be leveraged by public health practitioners to promote change in safe sex practices.

For example, within the context of use of CMC technologies, it remains unclear how the design of a CMC application influences the saliency of some attitudes and norms (e.g., permissiveness about hooking up) over others (e.g., I should negotiate condoms before meeting face-to-face)? This is where the authors feel that the offered framework could provide insights that impact design of CMC’s in a way that is both powerful and valuable.

Specifically, Research Questions R1, R2, and R3 could offer the requisite insights in defining these constructs from an HCI perspective. At their core, these Research Questions explore the means by which the individual or ‘subject’ approaches safer sex behaviors/activities within the context of use of CMC technologies in meeting sexual partners online. These questions explore and define these constructs of attitudes, norms, and behavioral controls more holistically by examining the

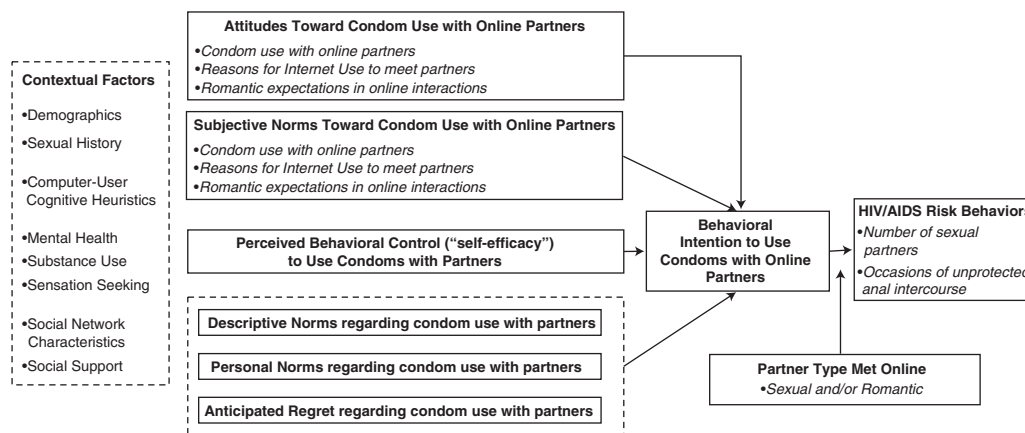


Figure 3 Conceptual model of HIV/AIDS risk based on the TPB.

use of technologies (tool), the analogous values and norms (rules), and the design stakeholders (division of labor).

Recently, the TPB has been expanded to include additional contextual and cognitive components (Kok *et al*, 2006, 2007; Mikolajczak *et al*, 2008). In Kok *et al*'s (2006) study, for example, the predicted variance of behavioral intention increased to 70% when three additional psychosocial constructs were accounted for: descriptive norm (i.e., perceived prevalence of the behavior in YMSM's social network), personal norm (i.e., feeling of moral obligation for one's behavior), and anticipated regret (i.e., anticipation of an emotional reaction following an unintended behavior). Inclusion of these three factors may help elucidate how YMSM's networks influence their sexual decision-making (e.g., descriptive norms), while also acknowledging YMSM's autonomy to negotiate their safety (e.g., personal norm and anticipated regret).

Research Questions R2, R4, and R5 offer insights that could inform a more holistic understanding of these three factors. While Research Question 2 begins to address those individual or personal norms, Questions 4 and 5 begin to delineate how online community norms and expectations influence YMSM's safer sex negotiation process.

Furthermore, the proposed model acknowledges that the proposed relationships are contextualized by demographic characteristics, cognitive factors, and network-level characteristics. For example, Internet-specific cognitive heuristics may influence attitudes, subjective norms, and perceived behavioral control, which, in turn, affect behavioral intention and HIV/STI risk behaviors. Furthermore, the strength of these associations may vary across racial/ethnic groups (Rimer *et al*, 1997; Montano & Kasprzyk, 2008), highlighting the importance of accounting for subgroup differences when measuring TPB constructs. Thus, these substantiating considerations could be offered in Research Questions R2 and R5.

As noted by prior research (Ennett *et al*, 1999; Smith *et al*, 2006), an understanding of the impact of network characteristics and the availability of social support within YMSM's network is vital in order to describe and understand how social processes influence YMSM's attitudes, norms (e.g., subjective norm, descriptive norm, personal norm) and intention to use condoms. Those network considerations within context of use are addressed in R4, R5, and R6, as these Research Questions afford understanding of the role of 'community context' and its impact.

As a group, these Research Questions begin to examine site characteristics, the design affordances of these sites, and how the design stakeholders – in the context of safer sex behaviors – appropriate these affordances. These questions offer an understanding of, not only how these stakeholders have shaped processes through their design activities, but also how evolving practices may be monitored, practices that may be shaping new attitudes

and norms that impact safer sex outcomes within a greater context.

## Discussion

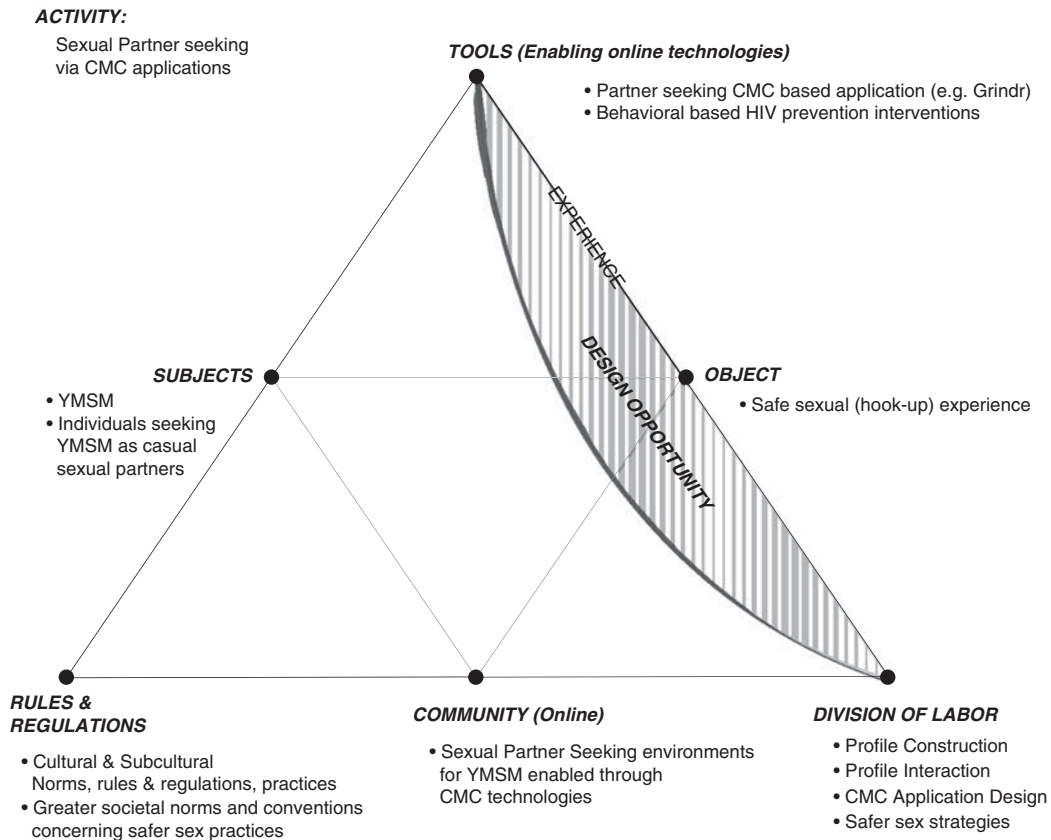
'The role of HIV prevention is not to interfere with where people meet, where they have sex, or how they have sex – with one expectation, and that is to advise people how (emphasis added) to have safer sex.' Benny Henriksson and Sven Axel Mansson (Henriksson, 1996). As a result of this research, the authors have come to believe that the offered questions converge to indicate a need for a more experiential or experience-driven design approach to HIV prevention for YMSM. As detailed in Rosenberger *et al* (2011), '... men are likely to be more responsive to public health efforts that consider their motivations and interests when going online'. Through the proposed Research Questions, public health and HCI researchers may obtain the insights required to inform more responsive prevention designs (i.e. experiences), and ground these prevention initiatives in the lives of YMSM (e.g., affording safer sexual experiences while enabling the user's achievement of pleasure and intimacy via the facilitation of the sexual encounter).

We feel that an experience-based approach is a plausible design direction. We highlight this assertion in Figure 4; illustrating the possible opportunity space resolving the design tensions described earlier. There is evidence to support the viability of experiential approaches in facilitating user safety in the context of CMC application use. For example, Hornet (<http://www.gethornet.com/>), a recent addition to the gay-oriented LBSN mobile app market, is making safety the focus of its design. Hornet is one of the first to introduce the 'Know Your Status' (KYS) campaign as a component of their app. Through KYS, Hornet encourages users to disclose their HIV status and keep it current on their constructed profile by featuring such experiential design elements as reminders to encourage users to get tested every 6 months. We believe that the offered activity model and analogous Research Questions, as evaluative mechanisms, could further advance this direction.

## Implications

Undoubtedly, in an increasingly technologically oriented world, online partner-seeking applications will continue to gain prominence and popularity globally (UNAIDS, 2011). The proposed work addresses several CMC-related challenges currently facing HIV prevention, domestically and globally. First, CMC applications may facilitate the embedding of sexual health promotion into partner-seeking applications. For example, Sanders *et al* (2012) highlight that improper condom use, as a HIV prevention strategy, is a global health problem. This research offers a framework by which HCI design opportunities could be uncovered and become more impactful at conveying proper condom use (e.g., just in time and place via the used CMC application).





**Figure 4** The activity theory model reflecting the experience design opportunity space.

For these efforts to work, it is critical that public health practitioners not only understand why and how YMSM use these applications to meet partners (i.e., subject to object), but understand the criticality in collaborating with HCI researchers and practitioners in garnering and leveraging this understanding. These multi/transdisciplinary collaborations may propose new, cutting-edge strategies to promote safer sex negotiation when YMSM seek partners online.

Second, we acknowledge that finding a balance between the public health imperative (e.g., promoting safer sex behavior) and designers' intentions (e.g., an application that facilitates a task, such as partner-seeking) may be challenging; however, these tensions may be lessened if both public health and HCI experts develop a new task goal for the user: the development of partner-seeking application that are both fun *and* safe. Further, as noted by Activity Theory, these efforts will need to continually revisit the users' ultimate goals and their perspectives on the design and content of these CMC applications.

While the implications of the proposed work hold great promise to the public health community in impacting HIV transmission among YMSM, works catalyzed through this effort also hold promise in advancing the discipline of HCI. The framework offered by this study suggests an important design context (HIV prevention) and offers a unique opportunity for the HCI community

to better understand and the varied socio-cultural factors and apply them to foster more effective health and wellness designs. While understood at a conceptual level as relevant considerations, there remain gaps between research and practice with regard to determining what these considerations mean and/or represent in actual design. In particular, this work certainly has the potential to advance the HCI community's understanding of sex and sexuality in informing design.

Though the case for involvement has been made and calls for work issued, explorations of sex and sexuality within HCI remain spotty and fragmented (Winchester, 2010; Kannabiran *et al*, 2011). In their critical analysis of the available discourse, Kannabiran *et al* (2011) offer several specific prescriptions as to how the conversation might move forward. Of particular interest are:

- (a) Their call to 'establish HCI as the expert domain of sexuality and technology in academic and corporate research' and
- (b) Their assertion that to further works in the area researchers should 'set aside sexual prejudices' (e.g., refusal to acknowledge the significance of homosexuality, transsexuality, and pornography).

In establishing HCI as the expert domain of sexuality and technology, Kannabiran *et al* (2011) state that, when



appropriate, technology and sexuality should be treated with equal rigor in informing design. Our offered framework supports this contention and provides a means by which this concept can be realized; aiding the designer in grounding her work within the activity of interest, the sexual act.

Not only affording insights on sexuality as a human factor in design, the current exploration initiates conversations around the role of sexual orientation in informing design, a topic markedly neglected within the current HCI and sex discourse (Kannabiran *et al*, 2011). Our work facilitates this exploration with the intent of offering specific insights into the role of sexual orientation and associated considerations in informing design. An established doctrine of human factors is the recognition of individual differences and an appreciation for their design implications (Sanders and McCormick, 1993). This study indicates that this doctrine should extend into the sexual lives of individuals. The offered framework provides a means by which this can be enacted both in research and in practice.

### Conclusion

Innovative approaches are required to curtail the increasing rates of HIV infection among YMSM. With more than 2.3 billion Internet users, 70 million of these users reporting daily use in the United States, and over 4.1 billion mobile subscriptions (Tryhorn 2009) CMC communications have become a salient medium for human interaction. Internet users interact with others through chat rooms, social networking sites, and dating websites (Hospers *et al*, 2002, 2005; Murphy & Research, 2004). Public health programs have sought to promote CMC-based HIV/AIDS prevention campaigns for MSM (Barak &

Fisher, 2001; MacMaster *et al*, 2003; Klausner *et al*, 2004; Bowen *et al*, 2007), and the evaluation of these programs has begun to receive attention (Hogben & Kachur, 2008; Levine *et al*, 2008; Mimiaga *et al*, 2008).

From a global perspective, the use of Activity Theory in public health and HCI research will be vital in examining differences in users' motivations for seeking partners and their usage patterns across different social environments (e.g., rural vs urban) and countries (e.g., China vs South Africa). Failure to acknowledge that these applications are modes of social interaction dependent on users' location and culture may result in design features that are unappealing and culturally insensitive. The work proposed here provides a series of questions that may be applied across social contexts in an effort to provide culturally relevant design recommendations for HCI and public health practitioners alike.

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