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# Digital communications and psychological well-being across the life span: Examining the intervening roles of social capital and civic engagement

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ABSTRACT

This study examined the relationship between multimodal connectedness (i.e. communicating with others through multiple digital channels) and subjective well-being. Analyses from a serial mediation model showed no direct relationship, but there were several significant mediating pathways through individual social capital, civic engagement and positive affect. Further analyses of three age cohorts (18–34, 35–54, 55–70 + ) demonstrated two significant indirect pathways for the 18–34 cohort, one for the 35–54 cohort, and five for the 55–70 + cohort. Even though the oldest cohort used fewer communication technologies and had smaller social networks, they are more likely to benefit from multimodal communications because they are motivated to engage in behaviors that result in positive emotions and feelings, which in turn engenders overall well-being. The study points to the utility of a lifespan perspective in understanding the effects of communication technologies in society.

## 1. Introduction

The study of subjective well-being (SWB) has long been a central concern not only for scholars, but also for policy advocates and lawmakers seeking to maintain or enhance quality of life among the citizenry (Helliwell et al., 2013; OECD, 2013). This is because of the accumulated evidence in the past decades showing that well-being is related to a variety of positive outcomes, including better health, longer life, more satisfying relationships and productivity, among others (Diener, 2013). Thus, works from diverse academic fields have been produced to explicate the antecedents of well-being. Psychologists for example have demonstrated the importance of the quality and quantity of social relationships on reducing mortality risk (Holt-Lunstad et al., 2010) while sociologists showed that active engagement in local community activities engenders greater satisfaction with life and society in general (Wallace and Pichler, 2009). In the field of communication, a large body of literature has focused on the impact of new communication technologies, with studies showing that certain uses of the mobile phone (Chan, 2015a) and social network sites (Burke and Kraut, 2016) have positive consequences for well-being and life satisfaction.

Most of the studies in the previous decades have examined the correlates of well-being. Less effort has been put into explicating the possible *mechanisms* that engender this key variable. This study provides an initial attempt by integrating the roles of social relationships and civic engagement into a parsimonious model to explain well-being. Underlying these predictors is the pivotal role of mediated communications that facilitate and maintain social relationships (Stafford and Hillyer, 2012) and opportunities to engage with the local community (Campbell and Kwak, 2010a). Indeed, interpersonal communications among one's close ties in today's

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social environment has become increasingly multimodal as face-to-face interactions with friends are often supplemented by a range of other channels as different needs and goals arise. This is possible because of the lower costs and availability of Internet access, digital devices like the mobile phone which facilitate anytime anywhere interactions, and a plethora of social network sites and messaging apps that facilitate different modes of communication and content. Communication between and among close ties provide important sources of information, social support and companionship (Leung and Lee, 2005), which in turn has positive outcomes for various aspects of everyday life that are beneficial for well-being.

Insights for the study are also drawn from the lifespan literature, which has consistently shown that individuals' well-being remain quite stable over their lifetimes despite their diminished physical and mental capabilities bought upon by aging as well as depressing life events such as the death of close ties (Ulloa et al., 2013). Therefore, it is worthwhile to examine the implications of the uses and effects of technologies as well as the nature of social relations and community engagement across different age cohorts as the pattern of relationships may differ (Chesley and Johnson, 2014; Wrzus et al., 2013). For example, older people may focus more on the quality of their communications and social relationships even though they may use fewer communication technologies and have fewer social ties compared to the younger cohorts.

The study is structured as follows. First, it reviews the relationship between mediated communication and well-being. Then, the roles of individual social capital and civic engagement are introduced as important mediators of the relationship as well as insights from the lifespan and gerontology literature. A theoretical model is proposed and is tested using a representative sample of adult citizens in Hong Kong, a city state with among the highest Internet and mobile phone penetrations in the world (OFCA, 2018). By integrating insights from different academic fields, this study responds to the call for communication scholars to "work more interdisciplinarily" so as to better understand the role of communication to promote and engender a "good life" (Vorderer, 2016).

## 2. Literature review

### 2.1. Multimodal communication and well-being in the digital age

Communication and well-being are inextricably tied because communication is a fundamental antecedent to the establishment and maintenance of interpersonal relationships. This "need to belong" as argued by psychologists, provides "a pervasive drive to form and maintain at least a minimum quantity of lasting, positive, and significant interpersonal relationships" (Baumeister and Leary, 1995), and such relationships in turn can engender positive feelings, emotions, and life satisfaction (Reis et al., 2000). Of course, communication with others can also be hurtful and may have negative outcomes. Nevertheless, all things being equal, the body of theorizing and research suggest that communication and social interactions are fundamental antecedents of well-being (Vorderer, 2016).

Communication among interpersonal relationships has long been characterized by multimodal connectedness, defined as "the various modalities through which people maintain their connections with each other in everyday life" (Schroeder, 2010)[1]. This is because individuals use more available modes of communication to maintain social connectedness with their close ties (Haythornthwaite, 2005). Before the Internet era, postal mail and the telephone were important supplement to face-to-face communications. Together, they helped individuals maintain social bonds by affording both synchronous and asynchronous interactions with others based in different geographical locations and/or time zones (Ledbetter, 2008). In the last two decades, the degree of multimodal connectedness has increased exponentially because of the growth of the Internet, social media, and mobile phone technology, giving rise to more ways to stay connected (Rainie and Wellman, 2012). Different technologies coexist because each one typically is more effective at fulfilling a specific communicative 'niche' or purpose (Dimmick, 2003). For example, e-mails are generally more suitable for sending long messages compared to text messaging, and messaging apps like WhatsApp may be preferred to text messaging when information needs to be sent quickly to certain predefined groups of recipients (Church and de Oliveira, 2013). Thus, multimodal connectedness has become the norm in today's digital communication environment because people use a variety of channels to connect with others, which in turn engenders greater well-being because collectively they fulfil the need to belong and the desire to sustain meaningful social relationships.

However, most studies on the implications of communication technology still focus on one technology in isolation, such as Facebook (Nabi et al., 2013) or mobiles (Hall and Baym, 2011). Of course, there is nothing inherently wrong with these approaches as they offer important insights on whether and how specific technologies engender well-being. But, such studies omit the holistic nature of how individuals use communication technology and its implications for social relations, civic engagement and well-being. The few exceptions include a study by Chan (2015b), which found that multimodal communications among strong ties was positively related to well-being, but the measure of multimodal connectedness was based on device ownership (e.g. tablet, laptop, desktop, telephone, and mobile) rather than the use of specific technologies for communications with friends, such as messaging and email. In another study, Boase (2008) used cluster analysis to show that 'heavy' communicators used a combination of in-person, landline phone, mobile phone, and email channels more often than 'light' communicators. These same individuals also typically had more friendship ties and diverse networks, leading to the author's important insight that multimodal connectedness is closely related with the relative complexity of one's social network. The more voluminous and diverse the network, the more channels of communication individuals use to stay connected with their social ties.

Of course, it should be noted that well-being is a very broad concept. Diener et al. (2009a) elaborated that there are at least three

[1] Boase (2008) also proposed the term 'personal communication system', which conveyed a similar idea to multimodal connectedness.

interrelated facets of SWB: an affective component comprising positive and negative emotions, which "reflects a person's ongoing evaluations of the conditions in his or her life"; a global life judgement component (i.e. life satisfaction), which reflects "judgements about the quality of a person's life"; and a domain specific component, which "reflects a person's evaluation of the specific domains in his or her life", such as family, work and health (p. 76–78). This study examines multimodal connectedness and its influence on two aspects. The first is *positive affect* because of its importance in the lifespan literature on well-being, which will be elaborated later. The second is general life satisfaction, or *psychological well-being,* because much of the life satisfaction research in various fields has been concerned with subjective evaluations of one's well-being (Cooke et al., 2016). Taking these into account, the first hypothesis is as follows:

H1: Multimodal connectedness is related to positive affect and psychological well-being.

### 2.2. A pathway through individual social capital

If high levels of multimodal connectedness are indicative of complex and diverse social networks as suggested in past research, an expected outcome would be increased access to use the resources embedded in such networks for personal gain. This is consistent with the relational view of social capital, defined as the "investment in social relations with expected returns" (Lin, 1999). Such returns can be both tangible or intangible. For example, individuals can gain social support from others during emotionally-difficult times or companionship while participating in shared social activities. More tangibly, they can obtain leads to potential new job opportunities or attain financial support in times of need. Granted, this is a somewhat pragmatic view of social capital as it emphasizes the relative 'value' embedded within social relations that a person may access. Nevertheless, diverse networks should provide more communicative opportunities and social interactions, which can engender greater feelings of belonging and well-being (Sandstrom and Dunn, 2014). Therefore, the following hypotheses are proposed:

H2: Multimodal connectedness is related to individual social capital.
H3: Individual social capital is related to positive affect and psychological well-being.

### 2.3. A pathway through civic engagement

In contrast to the relational view of social capital, the community view focuses on sociability for its own sake rather than instrumental gain. Perhaps the strongest proponent of this view is Putnam (1995), who conceived social capital in normative terms, defining it as "features of social life – networks, norms, and trust-that enable participants to act together more effectively to pursue shared objectives" (p. 664). In other words, social relations engender sociability, norms of reciprocity and trust within social networks, which provide the necessary foundations for greater community engagement in civic activities that contribute to the greater good. This ties in with a long tradition of research on citizens' role in civil society and in particular civic engagement, which comprise activities "intended to address public concerns directly through methods that are outside of elections and government" (Delli Carpini, 2004). Indeed, there is much evidence that communicative uses of technology, such as mobile phones (Campbell and Kwak, 2010b) and social network sites (Ellison and Vitak, 2015) are positively related to social capital because they are tools that engender and sustain sociability. In turn, a different body of research has long noted the psychosocial benefits of community engagement. Feelings of attachment to the local community is related to increased life satisfaction (Davidson and Cotter, 1991), and the actual experience of participating in different community activities has a variety of positive psychological outcomes, such as increased health, self-confidence and self-esteem (Attree et al., 2011). Based on the above discussions, the following hypotheses are proposed:

H4: Multimodal connectedness is related to civic engagement.
H5: Civic engagement is related to positive affect and psychological well-being.

Moreover, it is important also to emphasize the relationship between individual social capital and civic engagement given the evidence that network diversity contributes to greater civic engagement (Son and Lin, 2008). This leads to the final hypothesis:

H6: Individual social capital is positively related to civic engagement.

### 2.4. Multiple pathways to psychological well-being: A serial mediation model

Collectively, the previous hypotheses combine to form a serial mediation model as shown in Fig. 1 below. That is, while multimodal connectedness may directly predict well-being, it is also possible that the relationship is mediated by individual social capital and civic engagement. This is because multimodal communications should be related to the relative depth and diversity of one's social network, which in turn provides opportunities and incentives to engage in civic activities. Such engagement in turn should accentuate positive feelings and life satisfaction. While different literatures have provided substantive evidence for several of these bivariate relationships, this study represents a first attempt to integrate them into a logical and cohesive model.

There are several reasons for including positive affect and psychological well-being in the model as well as their causal ordering. First, well-being is a multidimensional concept that consist of emotional (affect) and perceptual (cognitive) domains so including both provides a more nuanced picture of the impact of multimodal connectedness on individuals'' overall well-being. Second, the

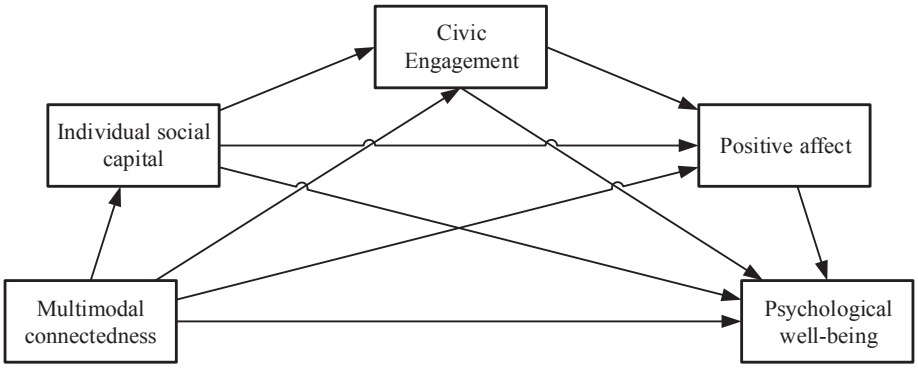


**Fig. 1.** Proposed serial mediation model from multimodal connectedness to well-being.

order follows the theorizing of well-being scholars who emphasize that affect precedes more global evaluations of life because emotional reactions follow initial appraisals of social interactions, which are then stored in memory and drawn upon when evaluating one's overall well-being (Diener et al., 2009a). This is also consistent with the view that emotional well-being is fundamentally derived from social relationships (Charles and Carstensen, 2010).

As shown in the model, there are multiple pathways in which multimodal connectedness can be related to well-being. Rather than state a hypothesis for every single indirect path, which will be too lengthy, the following general research question is raised instead:

RQ1: To what extent would individual social capital, civic engagement, and positive affect mediate the relationship between multimodal connectedness and psychological well-being?

### *2.5. A lifespan perspective*

As well as providing a parsimonious explanation linking mediated communication and well-being, another way to utilize the serial mediation model is to examine whether the same pathways occur across different age cohorts. After all, older people are often the late adopters of new technologies, have smaller social networks, interact less with others, and engage less in community activities (Chan, 2015b; Ihm and Hsieh, 2015; Stafford, 2015; Wrzus et al., 2013). Therefore, adopting a lifespan communication lens may provide additional insights on the relationship between communication technology use and well-being because it "deals with the description, explanation, and modification of the communication process across the life-span" (Pecchioni et al., 2005).

Despite their supposed attenuating circumstances, researchers have consistently found that older people do not exhibit substantively less well-being than their younger counterparts, a phenomenon known as the "paradox of well-being" (Swift et al., 2014). One explanation comes from socioemotional selectivity theory (Carstensen et al., 1999), which posits that older people are cognitively more aware of the availability of time and hence their impending mortality. Therefore, they are more motivated to actively seek out relationships and set personal goals that engender positive emotions and higher quality of life. As they age, they focus more on the quality rather than quantity of their social relationships, and are likely to dispense with peripheral ties and maintain connections with close and important ties such as kin and close friends (English and Carstensen, 2014). More recent research suggests that this strategy is even applied to social network sites like Facebook, with findings showing that while older Facebook users have fewer "friends" compared to young users, the proportion of actual friends are higher, which in turn was related to lower levels of loneliness (Chang et al., 2015). Another explanation is that older people are more adept at regulating their emotions through different "cognitive-behavioral strategies", such as avoiding negative situations or events altogether, and reappraising previous experiences in a more positive light (Charles and Luong, 2013). Thus, the need to belong and the innate motivation for positive emotion attainment and negative emotion avoidance among older people are inextricably linked, and sociability and community engagement provides the requisite conditions for them to derive emotional well-being and overall life satisfaction (Tiernan et al., 2013).

So, based on a life course perspective, what are the possible implications then for the proposed serial mediation model? First, it is very feasible based on the previous literature that older cohorts may indeed exhibit lower levels of multimodal connectedness, individual social capital, and civic engagement relative to the younger cohorts. This however should not impact the theoretical relationships among the variables proposed in the model. What may be different however are the pathways from multimodal connectedness to psychological well-being. Because older people are motivated to engage in activities that engender and sustain positive emotions, it is feasible that the serial mediation model for the older cohort may exhibit more indirect pathways through positive affect to psychological well-being, whether it is through communication, individual social capital, or civic engagement, which are all activities that have positive emotions as a beneficial outcome. This is in contrast with the younger cohorts who may communicate, maintain social relations, and engage in civic activities for more instrumental purposes, such as ego enhancement, social status, and the furthering of career opportunities. While these more instrumental motivations may indeed benefit overall evaluations of life satisfaction, they may not necessarily have the same impact on positive affect. In other words, the indirect pathway through positive affect may be less salient for the younger cohorts. Thus, the final research question is raised:

RQ2: To what extent would the pattern of relationships specified in RQ1 be similar or different across different age cohorts?

## 3. Method and data

### 3.1. Sample

Computer-assisted telephone interviewing (CATI) was conducted from June 22–30, 2016 by a university-affiliated research center in Hong Kong. The sampling frame adopted was based on the most updated residential landline directories of Hong Kong. To account for possible unlisted numbers, the last two digits were replaced by random values between 00 and 99 and the most recent birthday method was used to select respondents within each household. A total of 925 successful interviews were completed among Cantonese-speaking respondents aged between 18 and 70. For subsequent age cohort comparisons and analyses the sub-samples were grouped according to age ranges of 18–34 (N = 238), 35–54 (N = 343) and 55 and above (N = 341).

### 3.2. Measures of psychological and positive affect

The Psychological Well-Being Scale (PWB) was adopted (Diener et al., 2009b). Respondents indicated their level of agreement (*Strongly disagree* = 1 to *Strongly agree* = 5) to the following statements: 1) I lead a purposeful and meaningful life, 2) My social relationships are supportive and rewarding, 3) I am engaged and interested in my daily activities, 4) I actively contribute to the happiness and well-being of others, 5) I am competent and capable in the activities that are important to me, and 6) I am optimistic about my future. Answers to the questions were averaged to form a single scale (a = 0.78, M = 3.6, SD = 0.7).

The positive experience component of the Scale of Positive and Negative Experience (SPANE) scale (Diener et al., 2009a,b) was adopted to measure positive affect. Respondents were asked how frequency they had felt the following emotions in the previous month (*Never* = 1 to *A lot* = 5): 1) Happy, 2) Joyful, and 3) Content. The items were then averaged to form a single scale (a = 0.79, M = 2.9, SD = 0.7).

### 3.3. Measures of social capital and civic engagement

For civic engagement, respondents answered whether they engaged in the following list of activities in the previous six months (*Yes* = 1, *No* = 0): 1) volunteered time for local community service, 2) participated in a local fundraising event, 3) attended community meetings or forums related to a political or social issue, and 4) participated in local social club activities. Affirmative answers were added to form a cumulative measure of engagement (M = 1.3, SD = 1.1).

The same approach as Son and Lin (2008) was adopted to measure individuals' breadth and diversity of social networks and embedded resources, respondents were each asked whether they had a close friend who: 1) owns his or her own business, 2) is a school teacher, 3) receives welfare from the government, 4) has a different religion, 5) is a community leader, 6) is a political activist, 7) is from Mainland China, 8) is from overseas, and 9) is homosexual.[2] Affirmative answers were added to form a cumulative measure of individual social capital (M = 3.2, SD = 2.0).

### 3.4. Multimodal connectedness

Respondents were first asked the frequency (*Never* = 1 to *A lot* = 5) in which they use the following channels on a typical day to communicate with their friends: 1) Facebook page, 2) WhatsApp, 3) short text messaging, 4) mobile voice, 5) email, and 6) face-to-face. The measures were then recoded (Never = 0, 1 to 4 = 1) and added to form a cumulative measure of multimodal connectedness (M = 3.9, SD = 1.5). The measure is not aimed to be an exhaustive measure of all communication channels, but a broad representation of the most common ones used in Hong Kong. For example, Facebook and WhatsApp are the most popular social media technologies whereas others like Skype and Twitter are far less popular (GO Globe, 2015). Moreover, the ubiquity of mobiles with over 240% penetration (OFCA, 2018) means that this is the predominant form of voice communications in everyday life in Hong Kong rather than residential landlines, which have been experiencing a decline in recent years as more households shift to mobile.

### 3.5. Demographics

Demographics were included in all analyses as statistical controls. These include education (M = 4.5, SD = 1.8; '4′ = junior high, '5′ = senior high) and income (M = 4.0, SD = 2.2; '4′ = HK$30,000-HK$39,999). Moreover, respondents stated their gender (male = 47.6%), and whether they had a religion (Yes = 36.3%), are married (Yes = 61%), and whether they had children (Yes = 66.3%).

[2] Given that Hong Kong borders China, it may not be that unusual for a Hong Kong resident to have a friend from Mainland China. Therefore, an additional category of "overseas" is included.

**Table 1**
Sample characteristics.

| | 18–34 N = 238 | | 35–54 N = 343 | | 55 + N = 341 | | All N = 922 | |
|---|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| *Study variables* | | | | | | | | |
| Individual social capital | 3.7 | 2.2 | 3.3 | 1.9 | 2.8 | 1.8 | 3.2 | 2.0 |
| Civic engagement | 1.4 | 1.1 | 1.3 | 1.0 | 1.1 | 1.0 | 1.3 | 1.1 |
| Positive affect | 3.1 | 0.6 | 3.0 | 0.6 | 2.8 | 0.8 | 2.9 | 0.7 |
| Psychological well-being | 3.5 | 0.6 | 3.6 | 0.7 | 3.5 | 0.8 | 3.6 | 0.7 |
| *Communication* | | | | | | | | |
| FtF | 99% | | 96% | | 93% | | 96% | |
| Mobile | 91% | | 93% | | 82% | | 88% | |
| WhatsApp | 98% | | 90% | | 58% | | 80% | |
| Facebook | 85% | | 51% | | 23% | | 49% | |
| SMS | 70% | | 37% | | 20% | | 39% | |
| Email | 27% | | 42% | | 33% | | 35% | |
| Multimodal | 4.7 | 1.0 | 4.1 | 1.3 | 3.1 | 1.5 | 3.9 | 1.5 |
| *Demographics* | | | | | | | | |
| Education | 6.1 | 1.3 | 4.5 | 1.6 | 3.3 | 1.6 | 4.5 | 1.8 |
| Income | 4.5 | 2.0 | 4.4 | 2.1 | 3.2 | 2.2 | 4.0 | 2.2 |
| % Male | 51.5% | | 42.9% | | 49.9% | | 47.6% | |
| % Religious | 28.1% | | 37.0% | | 41.3% | | 36.3% | |
| % Married | 18.4% | | 80.2% | | 71.6% | | 61.0% | |
| % Children | 15.0% | | 78.6% | | 90.0% | | 66.3% | |

## 4. Results

### 4.1. Descriptive statistics

Overall and cohost-based descriptive statistics of the key variables are summarized in Table 1 below. Preliminary analyses of the key study variables using ANOVA showed that there were differences among the age cohorts for individual social capital, $F(2917) = 16.52$, $p < .001$, civic engagement, $F(2913) = 9.26$, $p < .001$, positive affect, $F(2901) = 20.26$, $p < .001$, and multimodal connectedness, $F(2917) = 105.75$, $p < .001$; though not for psychological well-being, $F(2893) = 0.73$, $p = .48$. In general, the oldest cohort had lower levels of individual social capital, civic engagement and positive affect compared to the younger cohorts. Though it should be noted that the difference for positive affect was fairly small whereas it is larger for individual social capital. This is generally consistent with the well-being and aging research showing that while their social networks contract over time, older people in general still maintain their levels of well-being (English and Carstensen, 2014).

For all cohorts, face-to-face was the predominant means of communication among friends, followed by mobile phone and WhatsApp. Facebook and SMS were used by the majority of the 18–34 cohort, but the same cohort had the lowest use of email. The fourth most used channel for the 35–54 cohort was Facebook whereas for the 55 + cohort it was email. As expected, the youngest cohort on average used more communication channels to interact with their friends and the oldest cohort the least.

### 4.2. Hypotheses testing

To test hypotheses 1–6, bivariate correlations were performed among the key variables while controlling for demographics. Results are summarized in Table 2 below. Multimodal connectedness was related to both positive affect and psychological well-being (H1), individual social capital (H2) and civic engagement (H4). Both individual social capital (H3) and civic engagement (H5) was related to well-being, and individual social capital was related to civic engagement (H6). Thus, all hypotheses were supported at $p < .001$. The exception was the relationship between multimodal connectedness and psychological well-being, which was

**Table 2**
Partial correlations of key study variables.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| 1. Multimodal connectedness (MC) | – | | | | |
| 2. Individual social capital (SC) | .23*** | – | | | |
| 3. Civic engagement (CE) | .11*** | .30*** | – | | |
| 4. Positive affect (PA) | .14*** | .13*** | .13*** | – | |
| 5. Psychological well-being (PWB) | .07* | .16*** | .18*** | .29*** | – |

*** = $p. < .001$, ** = $p. < .01$, * = $p. < .05$.

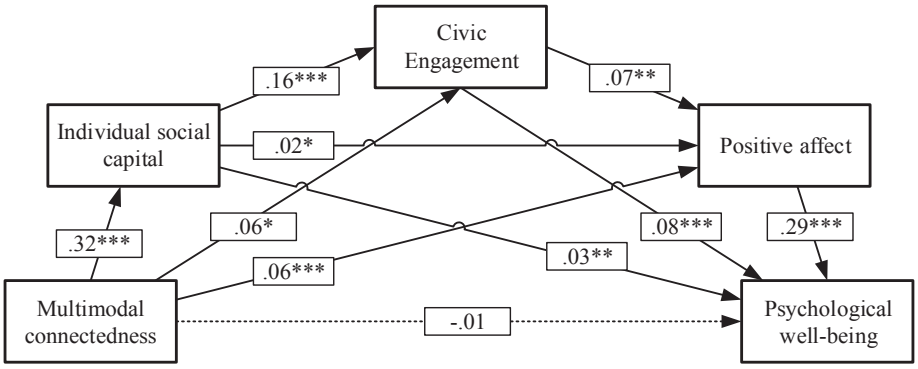


**Fig. 2.** Serial mediation model predicting psychological well-being for the whole sample. *** = p. < .001, ** = p. < .01, * = p. < .05.

significant at $p < .05$.

### 4.3. Testing the serial mediation model (RQ1)

Regression-based analyses of mediation using the PROCESS macro (Model 6) for SPSS (Hayes, 2013) was used to examine the extent in which individual social capital, civic engagement, and positive affect mediated the relationship between multimodal connectedness and psychological well-being for the whole sample. The analysis was conducted with 1000 bootstrap samples for bias-corrected confidence intervals and 95% confidence criterion, and all demographic variables were entered as control variables (i.e. education, income, gender, religiosity, marital status, and children). As Fig. 2 shows, the relationships among the variables are consistent with the partial correlations. The exception is that there is no longer a significant relationship between multimodal connectedness and psychological well-being. Instead, the relationship is indirect through four significant pathways at $p < .05$: 1) *MC → SC → PWB*, 2) *MC → SC → CE → PWB*, 3) *MC → CE → PWB*, and 4) *MC → PA → PWB*. Analyses by age cohort are reported next.

### 4.4. Analyses by age cohort (RQ2)

The same analyses reported for the complete sample were conducted for the three age cohorts and are summarized in Figs. 3–5. All the paths and the betas of the indirect effects from multimodal connectedness to psychological well-being for each model are summarized in Table 3. For the 18–34 cohort, the relationship between multimodal connectedness and psychological well-being was mediated through two significant pathways: one through civic engagement, and one through individual social capital and then civic engagement. For the 35–54 cohort only one indirect pathway was significant: through individual social capital. For the 55–70+ cohort five indirect pathways were significant: two through individual social capital and civic engagement, two through civic engagement, and one through positive affect. Overall, the findings suggest that the mediators play important roles between digital communications and psychological well-being, particularly for the oldest cohort, which exhibited the most significant indirect pathways. Implications of the findings are discussed next.

## 5. Discussion

For many decades, researchers from a variety of academic disciplines as well as policy makers have sought to identify and understand the factors and conditions that engender well-being. After all, individuals who are happy and satisfied with their lives are

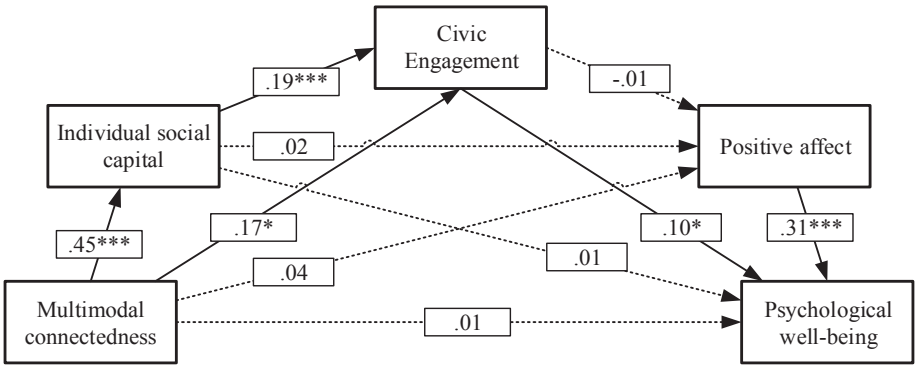


**Fig. 3.** Serial mediation model predicting psychological well-being for the 18–34 cohort. *** = p. < .001, ** = p. < .01, * = p. < .05.

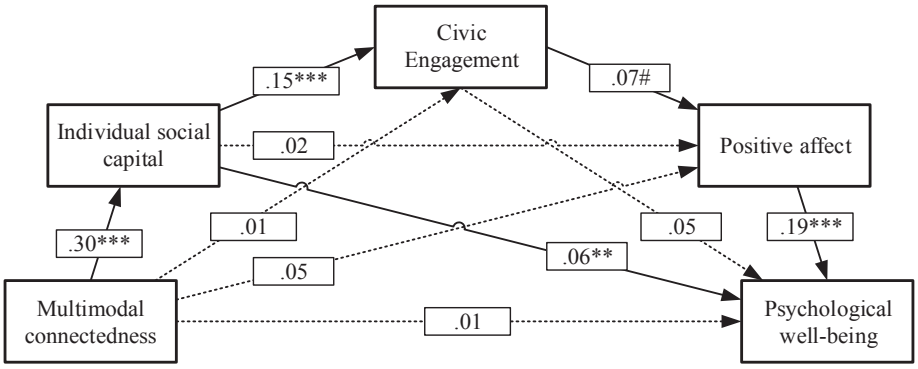


**Fig. 4.** Serial mediation model predicting psychological well-being for the 35–54 cohort. *** = p. < .001, ** = p. < .01, * = p. < .05.

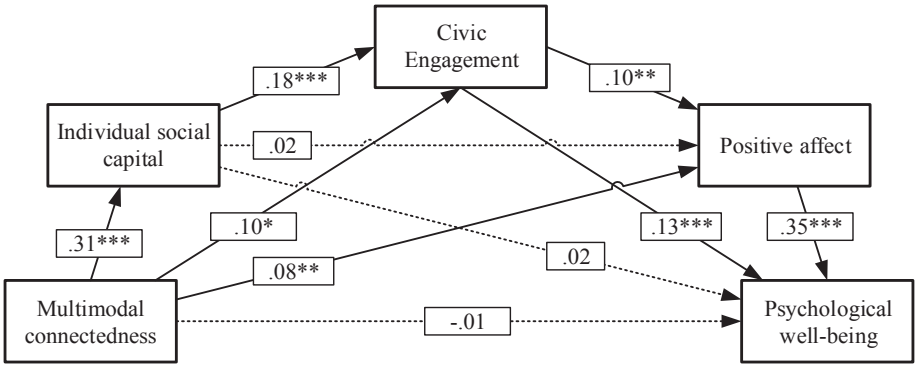


**Fig. 5.** Serial mediation model predicting psychological well-being for the 55–70+ cohort. *** = p. < .001, ** = p. < .01, * = p. < .05.

**Table 3**
Summary of direct and indirect effects through multiple pathways.

| | 18–34<br>B | 35–54<br>B | 55–70+<br>B | All<br>B |
|---|---|---|---|---|
| Direct effect (MC → PWB) | −.039 | .004 | −.009 | −.001 |
| Total indirect effect | .043* | .032* | .065* | .042* |
| MC → SC → PWB | .003 | .018* | .008 | .011* |
| MC → SC → CE → PWB | .008* | .002 | .008* | .004* |
| MC → SC → PA → PWB | .003 | .001 | .004 | .002 |
| MC → SC → CE → PA → PWB | .000 | .001 | .002* | .001 |
| MC → CE → PWB | .016* | .001 | .013* | .005* |
| MC → CE → PA → PWB | −.001 | .001 | .003* | .001 |
| MC → PA → PWB | .013 | .009 | .027* | .018* |

* = 95% confidence the beta is different from zero.

more likely to contribute to stable, harmonious, and civically-engaged societies. Yet, different academic disciplines have tended to focus on different correlates of well-being. So, while there is in-depth understanding of its predictors from the literature, there has been a lack of work examining the mechanisms in which the predictors engender well-being. This study thus fills the gap by bringing together relationships found in past research and integrated them into a cohesive model that explains well-being from a communication perspective. After all, communication is the foundation of social bonds and interactions, but in today's digital environment, there are many ways for individuals to connect with each other, and it is from such bonds that people can connect to the local community and engender positive emotions and evaluations of their lives. The addition of a lifespan perspective further sensitizes researchers to the reality that technology effects are not universal for everyone, and that people at different stages in their lives may have different motivations that drive their communicative behaviors, which in turn have different implications for well-being.

The overall findings point out the importance of multimodal connectedness, i.e. using multiple digital channels to supplement face-to-face interactions with the same people. Even when controlling for demographics, multimodal connectedness was positively correlated with all the key variables in this study. Moreover, it reinforces previous theorizing that the number of channels used to communicate with others is related to the relativity density and breadth of one's social network (Boase, 2008; Haythornthwaite, 2005). This is because each additional communication medium that an individual adopts increases "perpetual contact" by affording

anytime anywhere contact through a combination of text, audio and video (Rice and Hagen, 2010). This results in increased individual social capital, and the higher level of sociality provides greater opportunities and incentives to engage in civic activities, which in turn engenders greater psychological well-being because communication and social relationships fulfils the innate human desire to 'belong'. The utility of multimodal connectedness as a concept is that it encapsulates individuals' communication technology use more holistically, which contrasts with most studies that examine one technology in isolation. Therefore, future technology-focused studies of well-being may consider adopting this variable.

While the findings relating to the bivariate relations were insightful, the explication and focus on the *mechanisms* linking multimodal connectedness and psychological well-being is the key contribution of this study (RQ1). That is, communication not only has an antecedent role for well-being, but also for other consequential variables that also engender well-being. Indeed, as Fig. 2 shows, when individual social capital, civic engagement and positive affect were added as mediators, the direct relationship between multimodal connectedness and psychological well-being is no longer significant, but fully mediated through four pathways. These findings are similar to Chan's (2015a) study of mobile phone use and well-being, which showed that bonding and bridging social capital fully mediated the relationship between mobile use and psychological well-being. This suggests that relational variables such as social capital have important mediating roles in the relationship between communication and well-being and should be included in future theoretical models.

Sub-groups analyses by age cohort revealed more nuanced findings (RQ2). The most notable is that the 55–70+ cohort, which while having significantly lower levels of individual social capital, civic engagement and positive affect, exhibited five significant indirect pathways from multimodal connectedness to psychological well-being. In particular, the strongest indirect effect was through positive affect. Overall, three of the indirect effects were through positive affect. This can be explained by the lifespan literature on well-being that has long noted that older people behave in ways that maximize the fulfillment of emotional goals. In particular, socioemotional selectivity theory argues that people engage in behaviors that elicit positive emotions and avoid behaviors that cause negative ones (Charles and Carstensen, 2010). This ultimately leads to more positive evaluations of their overall lives. Thus, older people are more purposive in their communications and social relationships and configures them in ways to ensure positive emotions and experiences. In contrast, younger cohorts focus more on instrumental goals and needs rather than emotional gratification because they have a longer time horizon, which may explain why none of the indirect paths for the 18–34 and 35–54 cohort went through positive affect. For them, it is possible that multimodal communications with social ties are more for pragmatic purposes rather than positive affect because such connections have instrumental benefits. For example, people may not feel particularly close with their work colleagues, but nevertheless maintain close connections with them so as to stay abreast of company news and rumours. Linkages to weak ties such as acquaintances and participation in community activities may provide important connections that provide useful skills, information, and related career-related leads and opportunities, as demonstrated in Granovetter's (1983) seminal work. For them, having access to such instrumental resources can engender psychological well-being because the perceived access to benefits and resources. The different findings among the three age cohorts thus highlights the utility of adopting a lifespan approach to understanding the relationships between mediated communications and well-being.

### 5.1. Limitations and further research

Before the conclusion it is first necessary to elaborate on the limitations of the study and their implications for future studies. Firstly, the study was based in a technologically advanced society (i.e. Hong Kong) where Internet access and smartphones are ubiquitous among the general population. So, the results may not be generable to other societies, especially those with wide gaps of technology adoption that contribute to a substantive digital divide (Rice and Hagen, 2010). Therefore, applications of the model in other countries is necessary to test its explanatory power. Secondly, in the interests of presenting and testing a parsimonious model of communication technology use and well-being, several pertinent variables and measures were not included, but may need to be addressed in future studies. For example, the implicit assumption behind the model was that the need to belong is a primary driver of communication and sociability. Therefore, future studies may incorporate the actual measure of need to belong (Leary et al., 2013) because it is possible that those who do not desire social relationships may not derive any well-being benefits from social interactions. The measurement of individual social capital may also have to be expanded. The present study followed the measure of Son and Lin (2008), which admittedly provides only a general proxy on the depth and breadth of an individual's social network. Future studies may further incorporate more forms of social capital, such as bonding and bridging social capital (Putnam, 1995), because past studies suggest that strong tie networks positively moderate the magnitude of the relationship between multimodal connectedness and well-being because strong ties provide more social and emotional support as compared to weak ties (Chan, 2015b). An examination of the other components of subjective well-being, such as negative emotions and domain specific well-being will provide a more comprehesive picture of how mediated communication affects well-being. After all, social exchanges are not always positive, and social ties may not always be up to the task of fulfilling the need to belong or need for social support, which may diminish well-being (Rook, 2015). One way to achieve this is to incorporate the *negative affect* component of Diener et al. (2009a,b) Scale of Positive and Negative Experiences (SPANE) into the model. Also, while the present study did adopt the positive affect component of SPANE, it should be noted that only 3 of the 6 positive affect items were used due to time considerations that is inherent with the use of telephone surveys. Even though the reliability of the 3-items were very good, future studies should aim to use all six items for a more robust measure.

Despite these limitations, the present study increases our understanding of the different ways in which communication in today's digital environment can engender psychological well-being. Rather than view the relationship between communication and well-being as a simple direct one, it maybe more fruitful for future studies to examine the various important pathways in which the

relationship is mediated. Social capital and community involvement are two such mediators, though there may be others that can be further investigated. Moreover, the study sensitizes future research about the need to adopt a lifespan approach when considering how people of different ages or generations use communication technologies and the possible ways in which the meaning and impact of their use can be quite different from each other. Work has already began in this area (e.g. Chan, 2015b; Chang et al., 2015), but it is still very much in the nascent stage. The findings also have practical implications because they suggest that different strategies may be required to engender well-being among different groups of the population. This is important considering the phenomenon of rapidly-aging populations in many parts of the world. Therefore, serious attention and resources are being put into policies that engender health and well-being among the elderly, such as the "Age-Friendly" initiative by the World Health Organization, which aims to provide ways to promote the inclusion of older people into their local communities (Stafford, 2015). There are many ways in which this can be achieved. What this study has shown is that civic engagement is beneficial for positive affect and psychological well-being. At the same time, such engagement is preceded by social networks supported by multimodal communications. If having greater access and use of different channels of mediated communications can be a catalyst for many beneficial outcomes, then policies may be put in place to improve access and competence in the use of such technologies, especially among the elderly population. The findings thus illustrate the importance and benefits of interdisciplinary approaches to better understand and model the relationship between communication and well-being.

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## Declaration

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## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.tele.2018.05.003.

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