



been highlighted as a potential limiting factor in using these social media to build strong, emotionally intense relationships.<sup>14,18,21,22</sup>

The role of time constraints in affecting how Internet use impacts on social relationships has been extensively discussed (e.g., Bargh and McKenna<sup>1</sup> and Nie<sup>3</sup>). However, there are also likely to be cognitive constraints on the number of relationships that can be maintained at particular levels of emotional intensity.<sup>23,24</sup> Maintaining social relationships over time is a cognitively complex task, and individuals with better social cognitive abilities have larger personal networks.<sup>25</sup> Given these constraints on network size, the question becomes: Does use of social media allow these time and cognitive constraints to be overcome, and allow for more relationships and/or stronger relationships with existing network members?<sup>17,26</sup>

In this study, we focus specifically on the use of IM and SNS, rather than Internet use in general or use of chatrooms, as use of these social media appears to have most impact on social life.<sup>12</sup> We examine how time spent using these social media affects the number and quality of relationships in an individual's circle of family and friends, their personal network.<sup>27</sup>

We extend previous work in this area in two key ways. First, we asked participants to list explicitly each member of their personal, offline network. These personal networks consist of a series of subgroupings, arranged in a hierarchically inclusive sequence.<sup>24,28</sup> The successive grouping layers increase in size but decrease in the intensity of the typical relationship.<sup>29</sup> Thus we asked participants not just about the small number of people closest to them, but about all three layers of their network: the support group, the sympathy group, and the active network.<sup>24,28</sup> The mean size of these groupings is around 5, 15, and 50 respectively,<sup>24,28</sup> although they tend to vary depending on how the layers have been defined. Members of the support and sympathy group tend to be contacted frequently, and provide material and emotional support.<sup>30</sup> Members of the active network tend to be contacted much less frequently, and these relationships are much less emotionally intense.<sup>26</sup> The study therefore includes both strong relationships (support and sympathy group) and weak relationships (active network), enabling us to identify precisely which network layer social media use has an impact on. In contrast, previous research has not asked for details of specific relationships but tended to use overall measures of social capital, social support, well-being, or closeness to friends (e.g., Valenzuela et al.,<sup>2</sup> Wellman et al.,<sup>8</sup> Valkenburg and Peter,<sup>12</sup> Ellison et al.,<sup>31</sup> and Lee<sup>32</sup>).

Second, previous work has simply focused on the number of relationships an individual has (e.g., Kraut et al.<sup>33</sup>) or the frequency of communication with network members (e.g., Pew Internet<sup>7</sup>). However, quantity does not necessarily equal quality. Those with larger networks tend to be less emotionally close to each network member, suggesting a trade-off between the quantity and the quality of relationships and the influence of constraints on network size.<sup>26</sup> Thus in addition to offline network size, we also examine what impact social media use has on the emotional closeness of relationships with specific offline network members.

In light of the contradictory findings of previous research in this area, we do not make specific hypotheses about the

effect of social media use on personal networks, but instead identify two key research questions:

RQ1: What effect does the use of social media have on the size of each of the network layer (support group, sympathy group, active network)?

RQ2: What effect does the use of social media have on the emotional closeness of relationships within each of the network layer?

## Methods

### Participants

Due to the length of the questionnaire (which typically takes between one and two hours to complete), participants were recruited via the personal networks of students. Eight students (four male and four female) taking part in a compulsory practical course at a large European university were asked to complete a questionnaire, and were asked to hand out 19 surveys to friends, colleagues, and family. Participation was voluntary and anonymous (use of sealed envelopes to return surveys). This procedure was approved by the psychology ethics committee at the University where the study was carried out.

The final sample consisted of 117 participants, 73 women and 44 men. The return rate of completed questionnaires within a month was 73%. The sample was a mixture of university students and other participants not at university (71% aged 25 or younger; 29% aged older than 25). The mean age of the participants was 28 years (SD 12 years; range 18–63 years), and 86% of the participants did not have a completed university degree.

### Questionnaire

After some basic socio-demographic questions (including age, gender, educational attainment, and partner status), participants listed their complete, offline social network. This consisted of all their living relatives (kin, step, and adopted) and their friends and acquaintances. To elicit friends and acquaintances, participants were asked to look through their mobile telephone, e-mail lists, and address books, and to include everyone they personally know and would like to continue to have a personal relationship during the next year, as in previous research.<sup>26</sup> Participants were asked how emotionally close they felt to each person on a 1 to 10 scale (1 = not close at all and 10 = very close), and when they last had face-to-face contact with this person. Subsequently, they completed items on their media usage. Participants reported whether or not they used IM or a SNS (Do you use an IM program or SNS? Yes/no). If they reported using a SNS, they indicated how many friends they had in their online social network (typically listed as number of friends in Facebook, Hyves, or Netlog), and then estimated how many of those online friends they contacted weekly in any way. Participants also reported how many minutes on a typical day they used SNS and IM respectively (e.g., On an average day, how many minutes do you spend on a social network site? 1/2 minutes).

The support group was defined as those individuals with whom the participant had weekly contact and who scored eight or higher on the emotional support measure. The sympathy group was defined as the individuals with

whom the participant had contact within the last month. Weekly and monthly contacts have been shown to correspond to the support group and sympathy group respectively.<sup>29,34,35</sup>

Conceptually, the layers of the social network are hierarchically inclusive.<sup>34</sup> However, in this study, each layer was analyzed separately so as only to include the extra-individuals in that layer in each set of analyses.<sup>35</sup> Thus for the sympathy-group analysis, the members of the support group were not included, otherwise these offline network members would be included in two sets of analyses. Similarly, the outer layer of the network was calculated by subtracting the support-group and sympathy-group size from the total offline social network size. For the outer layer, we only counted the number of friends and not the number of family members: social media use might lead to adding more friends to the outer layer but not to adding more family, as the total number of relatives is not under an individual's control. For each of the layers (support group, sympathy group, outer layer), we calculated the average emotional closeness to individuals in that layer.

### Statistics

After presentation of descriptive statistics, correlations are presented for the three network layers (outer layer, sympathy group, support group) and new media usage. As a first step, we correlated the size of each network layer to social media usage. We subsequently tested whether controlling for potentially confounding variables substantially altered the strength of the correlation (partial correlations). As control variables, we used whether or not the participants had completed a university degree (0% male, 1% female), their age, and their gender (0% male, 1% female). These variables tend to affect network size and composition.<sup>26,36</sup> The same procedure was followed to examine if social media usage predicted average emotional closeness at any of the three layers.

We carried out two sets of analyses. First, we examined whether users of social media, compared with participants who did not use social media at all, had larger offline social networks or were closer to offline network members. Second, for only those participants who did use social media, we examined whether the amount of time spent using social media was associated with larger online or offline networks or closer relationships with offline network members.

Correlations are relatively robust to deviations from normality,<sup>37</sup> but where necessary variables were transformed to normalize the data as far as possible. Sensitivity power analysis by use of G-Power 3.1.2,<sup>38</sup> showed that our sample size allows detecting even weak effect sizes ( $r = 0.25$ ; Power 0.8).

### Results

#### Descriptive statistics

Mean support group size was 6.75 (SD 4.05; range 0–25; mean friends 3.51, mean family 3.24) and mean sympathy group size was 10.56 individuals (SD 7.79; range 0–42; mean friends 4.46, mean family 6.10). The mean number of friends in the outer layer was 22.16 (SD 14), giving a total mean offline network size (con-

sisting of support group, plus sympathy group, plus active network of friends) of 39.48 (SD 22.48; range 3–147).

Of the 117 participants, 102 indicated that they currently used IM or SNS. Of those who did use IM or SNS, the online social network of individuals (SNS friends) consisted on average of 180.42 individuals (SD 17.94; range 2–214). Of this online social network, participants reported that they contacted 13.94 individuals weekly (SD 18.82, range 0–150). In order to reduce the effect of potential outliers, online social network size and individuals contacted weekly online were log-transformed. This made the distributions of these variables not significantly different from a normal distribution (online social network size: Shapiro-Wilk's  $W = 0.98$ ,  $p = 0.353$ ; online weekly social network size: Shapiro-Wilk's  $W = 0.968$ ,  $p = 0.074$ ).

Participants who used social media reported that on average they spent 39 minutes on IM (SD 52; range 0–160 min) and 10 minutes on SNS a day (SD 11; range 0–160 min). In order to reduce the effect of outliers, we conducted a log transformation of these variables. This transformation made the distribution close to normal for IM (Shapiro-Wilk's  $W = 0.972$ ;  $p = 0.122$ ), but the log transformation (time spent on SNS) remained significantly different from a normal distribution (Shapiro-Wilk's  $W = 0.92$ ;  $p = 0.0003$ ). However, this log transformation was a strong improvement over the use of raw scores (Shapiro-Wilk's  $W = 0.877$ ;  $p < 0.0001$ ).

Is use of instant messaging or social networking sites associated with an increased offline and online social network size?

Participants who used an IM or SNS had slightly larger support groups, sympathy groups, and number of friends in the outer layer than participants who did not use IM or SNS at all (Table 1). However, these differences were not statistically significant, and remained not significant after controlling for age, gender, and having a university degree.

For participants who did use an IM or SNS, there was no significant correlation between time spent on IM and online social network size, but there was a significant correlation between time spent on IM and the number of individuals contacted online weekly. However, the partial correlation between time spent on IM and number of weekly online contacts (controlling for having a university degree or not, gender, and age) was not statistically significant. There was a significant correlation between time spent on SNS and online network size, as well as number of weekly online contacts. In contrast to the finding for IM, time on SNS remained positively associated with the total number of online contacts and the number of weekly contacts after controlling for age, gender, and having a university education. Thus those who spent more time on SNS reported more online contacts. However, the amount of time spent on IM ( $0.07 < r < 0.12$ ;  $p = 0.26$ ) or SNS ( $0.148 < r < 0.009$ ;  $p = 0.19$ ) did not correlate with size of any offline network layer. Controlling for age, gender, or having a university education did not substantially change the size or significance of these correlations.

The size of the online social network did not correlate with the size of any layer of the offline social network ( $r = 0.12$ ;  $p = 0.2$ ). The size of contacts contacted weekly online via SNS also did not correlate with the size of any network layer

Table 1. Raw and Partial Correlations Between Use of Social Media (Social Network Sites and Instant Messaging), Size of Network, and Closeness to Network Members. Partial Correlations Are Controlled for Age, Gender, and Having a University Education

| Variable                                    | Users vs. non-user of IM or SNS |               | Min per day on SNS |         | Min per day on IM |         |
|---|---------------------------------|---------------|--------------------|---------|-------------------|---------|
|   | Raw                             | Partial       | Raw                | Partial | Raw               | Partial |
| Size of offline network layer               |                                 |               |                    |         |                   |         |
| Support group                               | 0.156                           | 0.042         | 0.009              | 0.017   | 0.007             | 0.073   |
| Sympathy group                              | 0.061                           | 0.043         | 0.148              | 0.123   | 0.120             | 0.150   |
| Outer layer                                 | 0.135                           | 0.128         | 0.115              | 0.014   | 0.014             | 0.072   |
| Online network                              |                                 |               |                    |         |                   |         |
| Size of online network                      | $\frac{1}{2}$                   | $\frac{1}{2}$ | 0.214              | 0.214   | 0.118             | 0.117   |
| Number of weekly contacts                   | $\frac{1}{2}$                   | $\frac{1}{2}$ | 0.334**            | 0.289*  | 0.236*            | 0.147   |
| Mean emotional closeness of offline network |                                 |               |                    |         |                   |         |
| Support group                               | 0.164                           | 0.062         | 0.174              | 0.187   | 0.093             | 0.137   |
| Sympathy group                              | 0.082                           | 0.082         | 0.03               | 0.051   | 0.115             | 0.072   |
| Outer layer                                 | 0.101                           | 0.063         | 0.104              | 0.087   | 0.030             | 0.051   |

\* $p < 0.05$ ; \*\* $p < 0.01$ .

( $r = 0.12$ ;  $p = 0.2$ ). The size of these correlations was not substantially altered when taking into account potentially confounding variables such as age, gender, or having a university education.

Is use of instant messaging or social networking sites associated with an increase in average emotional closeness to offline network members?

Participants who used IM or a SNS (yes/no) reported being slightly less close on average with their support group and friends in their outer layer than those who did not. However, these correlations were not statistically significant and reduced in magnitude after controlling for age, gender, and having a university education. There was no association between using IM or a SNS and closeness with the sympathy group and controlling for age, gender, and having a university degree did not alter this result. Finally, the amount of time spent on IM ( $-0.12 < r < 0.009$ ;  $p > 0.25$ ) or SNS ( $0.03 < r < 0.17$ ;  $p > 0.1$ ) did not correlate with emotional closeness at any network layer. Controlling for age, gender, and having a university education did not alter these results. Given that there is a trade-off between average emotional closeness of a layer and the size of that layer, we checked whether additionally controlling for the size of the layer altered the findings for emotional closeness. This partial correlation was not significant in any of the cases ( $p > 0.3$ ).

## Discussion

In this study, we examined whether using IM and SNS was associated with the number of relationships at each layer of the offline network and the quality of these relationships. While participants that spent more time using SNS had more online friends and had a greater number of weekly online contacts, this did not seem to translate into a larger offline network. Thus there was no relationship between time spent using IM or SNS and the size of any of the three layers of the offline network (support group, sympathy group, outer layer). Further, spending more time on IM or SNS did not increase the emotional closeness of relationships in any of these layers. These two results held even after controlling for age,

gender, and having a university education. Finally, there was no difference in either offline network size or emotional closeness between those that used social media and those that did not use social media at all. Thus neither the use of IM and SNS nor the intensity of their use was associated with a greater number of offline relationships or the emotional closeness of these relationships.

These results contrast with previous findings, which suggested a positive impact of social media use on social relationships.<sup>12,14</sup> One possible reason for this difference is that the effects of social media use may be age specific, and the enhanced self-disclosure on social media may apply specifically to adolescents who are particularly prone to shyness and self-consciousness.<sup>12</sup> Further, previous research in this area has tended to rely on general measures of social well-being (social support, social capital, overall closeness to friends). Asking participants to list explicitly and rate their closeness to each offline network member may give a more accurate assessment of the composition of offline networks.

A more fundamental reason behind these results may be that social media use does not relax the time and cognitive constraints on offline network size sufficiently to allow for either larger networks or closer relationships with each network member. The findings of Nie<sup>3</sup> have come in for sustained criticism (e.g., Bargh and McKenna<sup>1</sup>), but his basic point is surely beyond argument: time is inelastic and there is a limited amount of leisure time in any given day. Time is a crucial constraint shaping primate sociality,<sup>39</sup> and recent diary studies with adolescents have shown that time spent using a computer does negatively affect time spent interacting with parents, though not time spent with friends.<sup>3,14</sup>

There are some limitations to the current research. Due to the length of the questionnaire participants were required to complete, this study used snowball sampling to recruit participants. This method has been successfully used in previous studies,<sup>26,40</sup> and one advantage is that it results in data from a broader range of ages and backgrounds than a typical student sample.<sup>41</sup> It remains to be seen, however, if these findings generalize to the broader population as a whole. Further, this study used a cross-sectional rather than a longitudinal design.



A longitudinal design would more clearly allow disentangling if and how increased social media usage influences the size and composition. Finally, in this study we used relatively crude measures for IM and SNS usage, not distinguishing between the various different activities participants may be doing on SNS. Moreover, the amount and SNS was relatively low, and, as such, it is possible that our sample did not contain sufficient heavy users. In spite of these limitations, our results suggest that use of SNS and/or IM appear to have a very limited impact on either the size or closeness of offline social networks.

There are two key issues for future work to address. First, exactly how the time and cognitive constraints act to limit offline network size and closeness in relationships is currently unclear.<sup>23,24</sup> A better understanding of these constraints would allow us to make more precise predictions about the effect of current and potential new forms of social media on the size and nature of offline networks. It may be that different constraints operate at different layers of the offline network.<sup>25</sup> Time diary studies, combined with detailed measures of offline and online social networks, would allow us to understand how much time people devote to socializing, how they divide this social time across these networks, how often they use different modalities of communication, and how these factors impact on network size and closeness to specific network members both offline and online. The cognitive constraints are also incompletely understood, but recent brain-imaging research<sup>42,43</sup> suggests that these cognitive limits may be relatively hard-wired, and thus may not be lifted by the use of social media (see also Stiller and Dunbar<sup>25</sup>).

A second and related issue for future research is exploring how effective different communication modalities are at maintaining social relationships. Social relationships are prone to decay over time, and each relationship needs active maintenance to prevent this decay.<sup>44,45</sup> Even if time on the Internet is spent on social media rather than on non-social activities, these media may be less effective at building and maintaining emotionally intense relationships than other types of communication.<sup>14,18,21,22</sup> Thus one view is that computer-mediated communication (CMC), compared with face-to-face communication, has reduced visual, auditory, and contextual cues, and is less good at signalling affect.<sup>3,21,46,47</sup> However, other researchers argue that precisely because of these reduced cues, CMC actually allows for greater self-disclosure and thus for communication to become unusually intimate and hyperpersonal, leading to stronger relationships.<sup>9,48,49</sup> Longitudinal research on how the use of different types of social media impacts on how relationships develop and change over time would address how effective these media are at building and then maintaining social relationships.

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