**Abstract**

Adolescent and young adults are exposed to and engage in online risky activities, such as giving out personal information and meeting online “acquaintances” in person. Surprisingly, little psychological research has examined this important issue. Drawing on fuzzy-trace theory, we examined differences in online risk taking in adolescents and young adults and assessed whether differential reliance on gist or verbatim representations could explain any differences. We asked 122 adolescents (aged 13–17 years) and 172 young adults (aged 18–24 years) to complete a series of questionnaires designed to examine past online risky behaviour, intentions to engage in future risky online behaviour, and gist and verbatim reasoning. Results show that adolescents had significantly higher intentions to take online risks than young adults. Past risky online behaviours positively predicted future intentions to take online risks. Furthermore, gist reasoning about risk negatively predicted intentions to take risks online while verbatim reasoning about risk positively predicted online risk intentions. Our results provide important insight into the underlying mechanisms involved in adolescents’ and young adults’ online risk taking, suggesting that we need to tailor the way we present online risk information to different age groups.

Key words: adolescents; fuzzy-trace theory; gist and verbatim representation; online risk taking; young adults

**Introduction**

At the age of 12 years, Shevaun Pennington disappeared with 31-year-old Toby Studabaker, who had befriended her online. The case sparked a Europe-wide manhunt and highlighted the potential dangers of Internet predators (Weathers, 2008). Fortunately, this case ended happily with Shevaun’s safe return home. Sixteen-year-old Sasha Marsden was less fortunate. Lured to a hotel on the promise of employment by a man she had met on Facebook, she was brutally sexually assaulted and murdered (Evans, 2013). Despite these high-profile cases and increased endeavours to provide online safety education in schools, extensive survey data suggest that adolescents are still taking, and suffering the consequences of, online risks. Livingstone and Helsper (2007) described how young people, in particular, can be exposed to content risks (commercial, violent, or pornographic content), become victims of cyber-bullying or harassment (Livingstone & Bober, 2004), and/or receive unwanted sexual solicitations (Ybarra, Mitchell, Finklehor, & Wolak, 2007). Yet surprisingly little experimental research on young people’s online risk taking exists. We sought to fill this gap by investigating the psychological mechanisms that underlie young people’s involvement in risky online activities.

**Young People’s Exposure to Online Risks**

Shevaun Pennington and Sasha Marsden’s tragic stories are rare and there are undeniably numerous benefits of using the Internet for young people, both educationally and socially (Valkenberg & Peter, 2011). A number of studies, however, reveal that young people are exposed to and engage in a range of risky activities online. Livingstone and Bober (2004) analysed data from over 1,500 9- to 19-year-olds’ use of the Internet, revealing that over 30% of the participants had received unwanted sexual solicitations or bullying comments via email or instant messaging. Up to half of the sample had also been involved in activities identified as risky, such as giving out personal information online, making unknown friends online, and meeting people offline that they had previously only known online. Other studies illustrate the ease with which personal information can be obtained from teenagers. Indeed, surveys conducted in different European countries, the United States, and Singapore have shown that between 13 and 91% of teenagers (depending on country of origin) supply their personal information to strangers online. Possibly more worrisome, between 9 and 20% have met online “acquaintances” in person (Livingstone, Haddon, Gorzig, & Olafsson, 2011; Ybarra et al., 2007). Of these, 9% had gone to the meeting expecting to meet another teenager only to find that the person they had been communicating with online was actually an adult (Liu, Khoo, & Ang, 2005).

Involvement in these risky online activities can increase young people’s chances of victimisation (Liu, Ang & Lwin, 2013). Ybarra et al.’s (2007) work has identified nine risky online activities: posting personal information, sending personal information, making rude/nasty comments to others, harassing/embarrassing someone else, meeting someone online, having unknown people on social networking friend lists, deliberately visiting porn sites, talking about sex with those known only online, and downloading from file-sharing sites. Seventy-five percent of 10- to 17-year-olds had carried out at least one of those nine activities and 28% did four or more. Those engaging in four or more of these behaviours were 11 times more likely to experience victimisation than those who did none, and seven times more likely than those who partook in one to three of these activities. Given the very real negative consequences of risky online behaviour (Byron, 2008) it is vital to have a better understanding of the factors underlying young people’s online risk-taking behaviours. Investigating online risk taking in more detail also nicely chimes with government policy. For example, in the United Kingdom, the Child Exploitation and Online Protection Service (CEOPS) government agency was specially formed to prevent and protect young people from online abuse, and “children’s behaviour putting themselves at risk of victimisation” was identified as a primary issue of concern (Child Exploitation and Online Protection Service, 2011, Centre Plan 2011/12, p. 13). Additionally, the European Commission and the U.S. federal government spend millions each year in research to evaluate young people’s online behaviour, risks, and safety (Walsh, Wolak, & Finklehor, 2012).

**Risk Taking Across Development**

Some researchers have argued that there is little distinction between offline and online behaviour, in terms of communication, building social relationships, and risk taking (Livingstone & Helsper, 2007). Others suggest that young people are more likely to take risks online, compared to offline, due to the extent and nature of the World Wide Web (Baumgartner, Valkenberg, & Peter, 2010a) and because their online activities are not as strictly monitored as offline behaviour (Livingstone & Helsper, 2008). To date, scant attention has been paid to the psychological mechanisms that might contribute to adolescents’ online risk taking, and few of the models and theories on young people’s offline risk taking have been tested in, and applied to, the online environment (Baumgartner et al., 2010b).

Traditionally, theories of judgement and decision making have suggested that rational and analytical reasoning processes increase throughout childhood and into adulthood aided by increased experience, intelligence, and memory capacity (Evans, 2008). Yet, a host of empirical studies have shown that risk taking is particularly prevalent in adolescence compared to childhood and adulthood, especially with regard to behaviours such as smoking, alcohol and drug use, reckless driving, risky sexual behaviour, and criminal activity (Blum & Nelson-Mmari, 2004; Centers for Disease Control and Prevention, 2011a; Currie et al., 2012; Quinn & Fromme, 2011; Zweig, Durbenstein-Lindberg, & Alexander-McGinley, 2001).

Several theories have been offered to explain the increase in risk taking in adolescence that refer to processes such as increases in sensation seeking and impulsivity (Donohew et al., 2000; Reyna et al., 2011; Steinberg, 2008). Steinberg et al. (2008) argued for a dual neurobiological model comprising a socioemotional system and a cognitive-control system. The socioemotional system develops early, and quickly, in adolescence and is believed to stimulate reward seeking. In contrast, the cognitive-control system matures much more slowly, resulting in a developmentally later attainment of impulse control and behavioural inhibition. This unequal maturation of the socioemotional and cognitive-control systems creates a period of vulnerability to risk taking starting at around 10 years of age and extending into young adulthood.

Other lines of research have proposed that risk taking in adolescence can be perceived as rational when individuals believe that benefits of a risky action outweigh its costs (Reyna & Farley, 2006). Consider an adolescent deciding whether to engage in unprotected sex. If the potential risks of the action (e.g., the probability of contracting a sexually transmitted disease) are perceived as relatively small and the potential rewards (e.g., having a thoroughly good time) outweigh these costs, the individual is likely to engage in the risky action (Fromme, Katz, & Rivet, 1997).

Many of the objective risks associated with young people’s online activities are rather small (e.g., making unknown friend online; Ybarra et al., 2007). However, research suggests that adolescents perceive the risks associated with some online behaviours as high and the benefits as low (Liu et al., 2005; Livingstone et al., 2011). For example, in relation to online sexual behaviours, such as talking to strangers about sex or sending sexual/naked photos of oneself, adolescents do not perceive lower risks or higher benefits associated with this behaviour compared to adults and are no less involved in these activities than adults (Baumgartner, Valkenberg, & Peter, 2010b). Baumgartner et al. (2010a) also found that adolescent’s perceptions of the risks and benefits associated with online sexual behaviour were not predictive of actual behaviour. These authors therefore suggested that this paradox could potentially be explained by fuzzy-trace theory because the theory focusses on non-normative behaviour driven by intuition.

**Fuzzy-Trace Theory**

Fuzzy-trace theory (FTT; Reyna & Brainerd, 1995, 2011) has emerged as one of the major paradigms to successfully explain adolescents’ and adults’ risk taking in domains such as health (Reyna, 2008) and sexual behaviour (Mills, Reyna, & Estrada, 2008; Reyna & Adam, 2003). FTT proposes that people use two different forms of mental representation when making (risky) decisions. Verbatim representations are based on specific details of events or judgements using exact, quantitative information. Gist representations are based on the meaning associated with events and are intuitive and qualitative. These representations can be influenced by an individual’s culture, emotional state, experience, and knowledge (Reyna & Farley, 2006). Individuals’ ability to utilise both verbatim and gist reasoning when making decisions increases from childhood to adulthood. However, FTT suggests that when making a risky decision, people prefer to adopt gist representations and ignore the exact (verbatim) numerical values. For example, the prevalence rate of HIV infection in the United Kingdom is around 0.13% (Health Protection Agency, 2008), but individuals rarely consider this figure when deciding whether to have unprotected sexual intercourse and instead simply rely on the gist that unprotected sex is risky and therefore should be avoided.

According to FTT, most adults consider risk categorically using gist representations: Is the action risky or not? For example, if adults perceive a risk, such as contracting HIV, to be present, they typically avoid the risky action regardless of the actual probability of it occurring (Rivers, Reyna, & Mills, 2008; Reyna et al., 2011). Reyna and Farley (2006) argued that adults intuitively get the gist of situations when forming judgements by retrieving risk-avoidant values and principles from memory that have often been influenced by past behaviours and experiences. In fact, representing information in a verbatim way or engaging in the systematic consideration of a cost–benefit trade-off analysis actually results in higher rates of risk taking. This is particularly true in situations where the perceived likelihood of a risky event taking place is low (Reyna & Brainerd, 1995). Conversely, relying on categorical gist reasoning (such as “avoid risk”) reduces risk-taking behaviour (Reyna & Brainerd, 2011; Reyna & Farley, 2006).

Studies in the FTT paradigm have shown developmental differences in children’s, adolescents’, and adults’ reliance on gist and verbatim representations. Reyna and Ellis (1994) and Reyna et al. (2011) found that children relied more on verbatim reasoning, weighing costs and benefits when making risky decisions, whereas adults relied more on gist, not verbatim, reasoning (Rivers et al., 2008). Reliance on gist reasoning was still developing in adolescence. Thus, compared to adults, adolescents were more likely to utilise both gist and verbatim reasoning and were therefore also more likely to take risks than adults (Reyna et al., 2011). In sum, FTT proposes that adolescents’ risk perceptions and risk taking are a consequence of a number of mechanisms working simultaneously. These mechanisms are dependent not only on neurobiological changes during development (e.g., Steinberg, 2008), but also on experience, memory, and whether risks are considered in a verbatim or gist fashion (Reyna et al., 2011). Essentially, adolescents are caught between mainly weighing the pros and cons of a risky action (or relying on verbatim representations), and mainly relying on gist representations to simply avoid risks (Rivers et al., 2008). Thus, the relatively stronger reliance on verbatim representations in adolescence can, paradoxically, result in increased risk taking compared to adults. Conversely, reliance on categorical gist reasoning ultimately reduces risk-taking behaviour in adulthood (Reyna & Brainerd, 2011; Reyna & Farley, 2006).

Following this line of reasoning, one important question is whether FTT can help explain adolescents’ and young adults’ online risk taking. To this end, we adapted measures developed by Mills et al. (2008). Basing their approach on psycholinguistics and memory research (Reyna & Brainerd, 1995), these authors assumed that representing information in different ways could cue either verbatim or gist representations of memories, thereby influencing the retrieval of risk-promoting or risk-avoidant principles (Reyna et al., 2011). By presenting participants with different measures intended to elicit either gist or verbatim representations, Mills et al. (2008) were able to show that verbatim cues were indeed positively related to, and reflective of, sexual risk-taking behaviour in adolescents. However, gist cues induced adolescents to retrieve simple risk-avoidant principles and perceive certain sexual activities as more risky, leading to less risk-taking behaviour. Indeed, Mills et al. (2008) and Reyna et al. (2011) demonstrated that intentions to engage in future sexual risky behaviours were negatively correlated with gist and positively correlated with verbatim reasoning.

**The Present Study**

The present study had two main aims: (1) to investigate developmental differences in online risk-taking in adolescents and young adults; and (2) to assess whether differential reliance on gist or verbatim representations can explain differences in adolescents’ and adults’ online risk taking. We focused on two major online risk taking behaviours identified by previous research: Giving out personal information online, and making ‘friends’ on social networking sites with unknown people (e.g., Livingstone et al., 2011; Ybarra et al., 2007). It was predicted that adolescents would display stronger intentions to carry out risky online activities than young adults.

The risky behaviours of giving out personal information and making unknown friends online are particularly suited to the FTT framework, as the risks are low while the potential benefits (e.g., increasing one’s group of friends) are more obvious. Following previous research of adolescents’ sexual risk-taking behaviour (Reyna et al., 2011; Mills et al., 2008), we presented participants with questions that were specifically designed to cue verbatim representations of online risk-taking behaviour and questions that were globally worded to induce gist representations of online risk taking. It was predicted that the gist measures used in the current study would correlate with each other and the verbatim measure would correlate with each other, but there would be no relationship between gist and verbatim measures. Additionally, the endorsement of, and agreement with, verbatim cues would be positively correlated with past online risk-taking behaviour and future intentions to take risks online, whereas endorsement of gist cues would be negatively correlated with past online risk taking and future online risk intentions. Past research has shown that young adults rely more on gist reasoning when making risky decisions, whereas adolescents rely on both gist and verbatim reasoning. We therefore expected that among adolescents both gist and verbatim reasoning would predict online risk taking, while among young adults only gist reasoning would predict online risk taking.

**Method**

**Participants**

Participants were students from three educational establishments in the southwest of England: one secondary school covering the age range 13–18 years, one further education (FE) college with an age range of 16–19 years, and one university with students ranging in age from 18 to 24 years, all undergraduate students in psychology. As Facebook use was a primary component of this study, and Facebook users must be 13 years or older, this was the minimum age stipulated for participant involvement. Parental consent was obtained from the parents of all students under 18 years old. Those with parental consent, or those over 18 years old, were then invited to participate. No incentives or compensation for involvement was offered to students at the secondary school or FE college. Undergraduate students participated for course credit. For analyses, participants were split into two age groups: adolescents 13–17 years old (*N*=122; 82 females; *M*age=15.04 years, *SD*=1.44) and young adults 18–24 years old (*N*=172; 142 females; *M*age=19.15 years, *SD*=1.10). Aside from age and gender, no other demographic information was collected.

**Materials**

Participants completed paper booklets containing the questionnaire items designed to examine past online risk-taking behaviour, risk perception, intentions to engage in future risky online behaviour, and gist and verbatim reasoning. Each participant was given a detailed brief and a consent form to sign.

**Gist reasoning about online risk taking.** Participants were presented with three individual measures (adapted from Mills et al., 2008) to assess their use of gist reasoning in relation to risky behaviours online; the *categorical risk* measure, the *gist principles* measure, and the *global risk perception* measure*.* Statements and questions were presented in such a way as to tap into participants’ representations of online risk. Items aiming to assess gist reasoning were global and generally worded and were expected to draw on general perceptions of risk (see below for examples).

The categorical risk measure included nine questions to measure gist reasoning, for example, “If you keep giving out your personal details online to people you don't know, risks will add up and you WILL have your details stolen”. Participants indicated their agreement with the statements on a 5-point Likert scale from 0 (*strongly disagree*) to 4 (*strongly agree*)and scores across the nine items were averaged (α = .75). Strongly agreeing to these statements indicated participants perceived higher risk compared to those participants who strongly disagreed.

The gist principles measure contained 14 statements (e.g., “Better to not accept unknown "friends" online than risk being bullied or harassed”) presenting general statements relating to online risk. Participants were asked to tick the statements they endorsed and leave blank those they did not endorse. A higher number of endorsements reflected higher risk perceptions. Four items were reverse scored and the number of endorsements summed (α = .64).

Global risk perception measures included two questions aimed at assessing gist-based perceptions of risks (“Overall for YOU which best describes the risks of giving out your personal details online?” and “Overall for YOU which best describes the risks of making friends online with people you do not already know offline?”), measured on a 4-point scale of 0(*none*)*,* 1(*low*)*,* 2(*medium*)*,* and3(*high*). These two questions were found to be significantly correlated, *r*(292)=.472, *p*<.001, and therefore scores were combined and averaged to create one global risk perception variable.

**Verbatim reasoning about online risk.** Participants were presented with three questions aimed at assessing their use of verbatim reasoning, adapted from Mills et al. (2008). *Specific risk* involved two verbatim-focused questions that were specifically worded to assess participant’s perceptions of their own future risk from using the Internet. Participants were asked to rate, on a 5-point Likert scale scored from 0 (*very unlikely*) to 4 (*very likely*), the statements “I am likely to have my personal details stolen and used against me in the next 6 months”, and “I am likely to be bullied or harassed online in the next 6 months by a person I do not know offline” (α = .81). As these two measure significantly correlated, *r*(295)=.678, *p*<.001, they were summed and averaged to create one specific riskvariable (α = .81).

For the *quantitative risk* scale participants were asked “What are the chances that your personal information has been stolen?”. They indicated their answer on a scale ranging from 0 to 100%.

**Past online risk taking and intentions to take online risks***.* Participants were asked to indicate if they had ever given out personal information online or made friends with someone they knew only online in the past 12 months. If they responded yes to either of these questions, participants were then asked to indicate how many times they had displayed this behaviour in the past 12 months, thus creating two variables measuring frequency of past risk-taking behaviour for giving out personal information and making unknown friends online, respectively.

Four questions measured participants’ intentions to take online risks, assessing whether participants intended to give out their personal information, make unknown friends, communicate with unknown people in chat rooms, or share personal information with people they knew only online in the coming year. Participants answered on a 5-point Likert scale scored from 0 (*very unlikely*) to 4 (*very likely*). These four intentions measures were found to correlate significantly with each other. Therefore scores were summed and averaged to create an *online risk intentions* variable (α = .72).

**Procedure**

The study received ethical clearance from the university’s behavioural ethics committee. Students from the secondary school and the FE college were tested in groups during morning registration periods. After students personally gave consent to participate, they were seated at separate tables and asked to complete the questionnaire in silence. Once questionnaires were completed each participant was provided with a debrief document.

For the undergraduate students, the questionnaire was converted into a web-based survey that could be accessed through the University’s participant recruitment scheme. Respondents were invited to participate in the research study and instructed to click on a web link for more information. The participant information sheet was presented on screen and students provided consent by ticking a check box. Participants were instructed to consent and continue only if they were between 18 and 24 years old. The participant was then guided through the questionnaire pages to complete each individual measure. At the end of the survey a debrief with more detailed description of the aims of the research was given to participants.

**Results**

**Past online Risk Taking and Intentions to Take Online Risks**

Table 1 shows the means and standard deviations for past online risk taking and intentions to take online risks for each age group. Independent-samples *t* tests revealed that adolescents had significantly higher intentions to take online risks than young adults, *t*(294)=2.43, *p*=.016. Adolescents had also made significantly more unknown friends online than young adults, *t*(108)=2.01, *p*=.047.

**Relationships of Gist and Verbatim Measures**

Fuzzy-trace theory predicts that the two verbatim measures of risk perception (specific risk and quantitative risk) should positively correlate with each other, as should the three gist measures of risk perception (categorical risk, gist principles, and global risk perception). However, gist and verbatim measures should not correlate with each other. Table 2 shows the intercorrelations between all verbatim and gist measures. Both the specific risk and quantitative risk verbatim measures were significantly and positively correlated. All three gist measures were also significantly and positively correlated. However, while neither the categorical risk nor the gist principles gist measures were correlated with either of the verbatim measures, the gist measure global risk perception showed a significant relationship with both verbatim measures.

**Gist and Verbatim Representations and Risky Behaviours**

According to FTT and the findings of past research (Mills et al., 2008; Reyna et al., 2011), each of the verbatim measures of risk perception should positively correlate with past risk-taking behaviours and with intentions to engage in these risk behaviours. Conversely, each of the gist measures should negatively correlate with each of the past risk-taking and intentions measures. However, research has also shown that the influence of verbatim representations on risk taking declines with age. Therefore, we analysed the relationship between gist and verbatim measures, past online risk taking, and intentions to take online risks separately for each age group.

Table 3 displays the correlations between each of the gist and verbatim measures, past online risky behaviour, and online risk intentions for the adolescent age group. For gist measures, Categorical risk and gist principles showed significant negative correlations with future intentions to take online risk. Global risk perception was not related to intentions to take online risks. For verbatim measures, specific risk showed significant positive correlations with intentions to take online risks. None of the gist or verbatim measures were significantly correlated with past online risk taking.

Table 4 shows the relationships between each of the gist and verbatim measures, past online risky behaviour, and future online risk intentions for young adults. The two gist measures, categorical risk and gist principles, were positively and significantly correlated with intentions to take online risks. However, neither of the verbatim measures was significantly correlated with intentions to take online risks. Except for gist principles, which correlated significantly negatively with past risky behaviour related to making unknown friends online, none of the gist and verbatim measures correlated significantly with past risky online behaviour.

**Predicting Intentions to Take Online Risks**

Due to the intercorrelations of the gist and verbatim measures, we first conducted a principal component analysis on all five (three gist and two verbatim) measures with orthogonal rotation (varimax). Two components, incorporating all five items, had eigenvalues over 1 and together accounted for 62.90% of the variance. Table 5 shows the factor loadings after rotation, which suggest that all three gist measures loaded onto Component 1 (gist component) and both verbatim measures loaded onto Component 2 (verbatim component).

To assess the roles of age group, past online risk-taking behaviour, and gist and verbatim reasoning in future intentions to take online risks, we conducted hierarchical linear regressions. In Step 1 the independent variables of age, the mean-centred number of incidents of sharing personal information, and the mean-centred number of incidents of making unknown friends were entered. In Step 2 the gist component and verbatim component were also entered. Step 3 additionally included the interaction terms of Sharing of Personal Information × Age, Making of Unknown Friends × Age, Gist Component × Age, and Verbatim Component × Age. Results can be found in Table 6.

The first regression model showed that age and past risky behaviours significantly predicted intentions to take online risks, *R*2 = *F* (3,264) = 16.98, *p*<.001. Age negatively predicted intentions to take online risk; that is, adolescents showed stronger intentions to take online risks than young adults. Past risky behaviours (both in terms of giving out personal information and making unknown friends online) positively predicted intentions to take future risks online. That is, the more risky online behaviour participants engaged in in the past, the higher their intentions to take online risks.

The results of the second regression model showed that the gist and verbatim components additionally predicted online risk intentions, *R*2 = *F* (5,264) = 27.51, *p*<.001. Gist reasoning about risk negatively predicted intentions to take risks online while verbatim reasoning about risk positively predicted online risk intentions. Some of the interactions between age group, past online risk-taking behaviours, and reasoning style (either gist or verbatim) additionally predicted online risk intentions in the third regression model, *R*2 = *F* (9,264) = 19.97, *p*<.001. The interaction Verbatim Component × Age and the interaction Making of Unknown Friends × Age were both significant.

To further analyse these interactions, we calculated the slope and plotted the interactions following the procedures by Aiken and West (1991). For the interaction of Verbatim Component × Age the slopes were 0.32 (*p*<.001) for the adolescent age group and 0.13 (*p*=0.02) for the young adult age group. Figure 1 shows that for both age groups, an increase in verbatim reasoning resulted in higher intentions to engage in online risky behaviours, but this was much more pronounced for adolescents. For the interaction of Making Unknown Friends × Age, slopes were .05 (n.s.) for adolescents and .47 (*p*<.001) for young adults. As shown in Figure 2, intentions to take online risks increased with the number of unknown friends made in the past for young adults, but not for adolescents.

**Discussion**

Media reports are rife with stories about teenagers taking their own lives due to cyber-bullying (Topping, 2013) or young people being blackmailed by abusers into performing sexual acts and self-harm on live webcam links (CEOPS, 2013). Although a growing number of researchers have turned their attention towards this rather novel domain, there is a dearth of empirical studies examining adolescent and young adult online risky behaviours. This study was designed to bridge this important gap by examining two prominent and ubiquitous online risk-taking behaviours, namely, posting personal information and making friends with strangers online.

Previous research has shown that adolescents are more likely to engage in offline risky behaviour compared to young adults (Reyna et al., 2011). Our first objective was to evaluate if these findings are robust enough to be applicable to the online environment, as well. Our results indicate, first, that adolescents took significantly more online risks in the past and showed stronger intentions to take online risks in the future compared to young adults. Specifically, adolescents had made 10 times more unknown friends online in the past 12 months on average compared to young adults. Adolescents also stated that they were more likely to engage in future online risky activities including making unknown friends, sharing personal information, communicating in chat rooms with strangers, and sharing personal information with strangers, compared to young adults. Our data, in line with findings of previous work, provide further evidence that adolescence might represent a precarious period with regard to risk-taking behaviour, whether it is offline or online.

Building on the influential FTT (Mills et al, 2008; Reyna et al, 2011), the present study was also designed to assess whether adolescents’ and young adults’ mental representations of risk, exemplified by gist or verbatim statements, were related to their previous and intended online risk-taking behaviour. As argued by FTT, verbatim representations are quantitative and are based on precise details for events or judgements. Gist representations, on the other hand, are qualitative and intuitively draw on the essence or meaning of events. Following Mills et al.’s (2008) earlier work, reliance on verbatim or gist representations was manipulated by wording questions and statements either to cue precise memories of online risk taking (verbatim) or to cue global principles associated with online risk taking (gist).

FTT predicts that the concepts of gist and verbatim representations can be used to explain why some risk perceptions are influenced by past behaviour and some by general beliefs. Specifically, and as predicted in this study, verbatim measures should be positively correlated with participants’ risky behaviours, whereas gist measures should be negatively correlated with risky behaviours. The findings of this study provide partial support for these predictions. In both age groups, gist measures (with the exception of global risk perception) were negatively related to intentions to engage in risky activities. In contrast, reliance on verbatim representations positively predicted online risk intentions, particularly among adolescents. Our data, therefore, suggest that individuals who reason more globally and intuitively about online risk and hold more risk-averse beliefs about online activities are less likely to engage in future risky behaviour online. Conversely, individuals who were more likely to draw on their own past experiences of online behaviour, and subsequent outcomes, would be more likely to display future online risky behaviour.

Mills et al. (2008) argued that gist representations are meant to be prospective and “guide real-life decision making” (p. 433), in that simple values and decision rules concerning a specific risky behaviour will deter individuals from engaging in that behaviour. The present findings lend support to their assertion: Individuals who were more likely to endorse simple general statements such as “avoid risk”, or “Better to never give out personal information online than risk having my identity stolen”, were less likely to intend to engage in these activities in the future. The opposite was true (i.e., higher past risk taking and behavioural intentions): Individuals who were less likely to endorse these global statements showed greater proclivities to engage in future online risky behaviour.

Our results, especially for the adolescent sample, showing that increased verbatim reasoning resulted in stronger online risk intentions is nicely in line with previous research (Reyna et al., 2011). The strong negative relationships between categorical risk and gist principles measures and online risk intentions for these measures in both of the age groups support the protective nature of global beliefs, suggesting that these beliefs will indeed inhibit individuals from engaging in risky online activities in the future. This has clear implications for intervention and the way that online safety education should be framed in order to best protect young people’s online activities. That is, our results suggest that ensuring that safety programmes and initiatives specifically incorporate stable gist representations that can be easily retrieved from memory and highlight the potential dangers associated with risky online activities has the potential to protect adolescents and young adults against online risky behaviour (Rivers et al., 2008). While our study design can only allude to this possibility, it is important that future research be designed specifically to examine this idea.

Following FTT we predicted that gist reasoning would increase with age and be more strongly associated with risk taking. Our data, however, did not support this hypothesis. One important factor could help explain why the young adult group utilised gist more frequently and/or effectively. It is very feasible that activity-specific experience contributed to the present findings, since earlier work focused on sexual risk taking. Participants in Mills et al.’s (2008) and Reyna et al.’s (2011) studies, for example, were between 14 and 22 years old and none of the 14-year-olds in these studies had any sexual experience. In fact, only a minority (6.2%) of under 13s in the United States have had any sexual experience (Centers for Disease Control and Prevention, 2011b). In contrast, the vast majority of young adolescents have extensive online experience. Indeed, in Europe the average age of beginning regular Internet use is 9 years old (Livingstone et al, 2011). Having experience in the online environment could have contributed to the development of gist representations and adolescents’ more extensive reliance on them when forming judgements about risk (Reyna, 2012; Rivers et al, 2008). Consequently, there would be little difference in online experience between the two age groups and therefore very little difference in the ability to reason in an intuitive, experience-based fashion. In line with predictions, however, our results showed that, while building gist representations of risk, adolescents also drew more on verbatim cues to risk taking compared to young adults. Therefore, as predicted by FTT, increased gist reasoning was protective of risk taking for all participants, but an increase in verbatim reasoning, as displayed by adolescents, predicted increased risk taking.

Being able to predict future behaviour based on individual’s mental representations of the risks associated with different activities is clearly an important finding, especially since future risky behaviour could be modified in order to reduce any associated negative outcomes. Besides reliance on gist and verbatim representations, participants past risky online behaviour significantly predicted intentions to take online risks. The more participants gave out personal information and made unknown friends online in the past, the more likely they were to engage in risky online behaviour in the future. Interestingly, past risky behaviour of making unknown online friends was particularly predictive for young adults’ online risk intentions. Specifically, although adolescents made more unknown friends online, young adults who continued with this behaviour were more likely to report increased online risk intentions. Research suggests that young people perceive some online behaviours as high risk (Liu et al., 2005) even though objective risks are low (Ybarra et al., 2007). However, Hertwig and Erev (2009) proposed that when making decisions based on experience, people tend to underestimate the risks associated with rare events. Therefore when induced to draw specifically on one’s own personal experiences of making unknown friends or giving out personal information online (that is, using verbatim representations), young adults may have had very few (if any) past negative experiences on which to base their risk estimations. Additionally, as skill with and experience of the Internet increases so individuals’ exposure to risk appears to decrease (Livingstone & Helsper, 2008). It would therefore seem reasonable that young adults who had had very little experience of bad outcomes associated with making unknown friends online would underestimate risk and consequently show stronger intentions to engage in risky behaviours in the future. Given that this study has highlighted the relevance of past experience in the formation of attitudes towards intentions to engage in risky online behaviours, it would certainly be pertinent to explore the importance of experience in more depth.

Our study is not without limitations. As has been highlighted in previous research investigating online behaviour (e.g., Baumgartner et al., 2010a,b), the novelty of investigating online risky behaviour, particularly with young people, necessitates the use of measures that have been adapted from paradigms used in offline environments or newly created. As such, further improvement through additional testing is obviously needed. This could potentially affect the findings of this study in terms of its measure of FTT but also its applicability to the online environment. Additionally, individuals’ experience with the Internet and the online environment was not assessed. As already mentioned, it is probable that many of the participants, even the youngest, had extensive experience of using the Internet and different social networking media. Certainly, experience (hours per day and week and age since beginning to use the Internet) should be incorporated into future research to better understand how it might influence gist and verbatim representations. While studies have shown that online risky behaviour is common in many counties across the globe, our participants were drawn from the southwest region of the United Kingdom. It is unclear, thus, whether our sample is representative of adolescents and young adults in other places. Finally, as with other studies (Mills et al., 2008), our investigation was hypothetical by nature and did not measure actual behaviour. It would be extremely useful, needless to say, to follow adolescents’ and young adults’ online behaviour and examine whether gist or verbatim representations actually modify their online behaviour.

Despite the above limitations, these findings have a number of important implications. First, in line with previous results (Ybarra et al, 2007), a large percentage of young people (over 50% of all age groups) admitted taking online risks such as giving out their personal information to strangers and making friends with people on social networking sites whom they did not already know offline. The data also reveal that the main facets of FTT, namely, the utility of gist-based intuition and verbatim-based analysis of risk-taking judgements, can be applied to the online environment. Certainly, the gist measures of online risk taking showed protective properties when related to future intentions to engage in risky online behaviour for both age groups, and the use of increased verbatim reasoning was predictive of increased online risk intentions in adolescents. This may serve as an important factors in online training and education for both preventative and protective measures. Developing and imparting more gist-based knowledge in order to engage more intuitive thinking about risk taking may well help to protect young people against some of the dangers involved in certain online activities. Currently Internet safety education has become far more widespread, not only for young people in schools but also for teachers in training and parents, but it requires wider implementation and effectiveness (Byron, 2008). Further research on adolescents’ online risk taking will not only help identify the decision-making processes involved when making risky decisions about online activities, but will also help develop more effective education strategies that can encourage young people to reap the benefits of the virtual world while also protecting them against potential threat.

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Table 1

*Mean Scores (and SDs) for Past Online Risk Taking and Online Risk Intentions by Age Group*

|  |  |
| --- | --- |
| Variable | Age group |
| Adolescents | Young adults |
| Past online risk taking: Sharing personal information | 4.36 (12.44) | 6.71 (12.02) |
| Past online risk taking: Making unknown friends | 11.75 (52.96) | 1.49 (3.78) |
| Online risk intentions | 1.58 (.93) | 1.33 (.84) |

Table 2

*Intercorrelations of Gist Measures (Categorical Risk, Gist Principles, Global Risk Perceptions) and Verbatim Measures (Specific Risk Perceptions, Quantitative Risk) for Online Risk Taking*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Measure | Categorical risk | Gist principles | Global risk perceptions | Specific risk perceptions |
| Categorical risk |  |  |  |  |
| Gist principles | .437\*\* |  |  |  |
| Global risk perceptions | .255\*\* | .177\*\* |  |  |
| Specific risk perceptions | .069 | .014 | .154\*\* |  |
| Quantitative risk perceptions | .075 | .039 | .169\*\* | .509\*\* |

\**p*<.05. \*\**p*<.01.

Table 3

*Correlations of Past Online Online Risk Taking and Online Risk Intention Variables with Gist (Categorical Risk, Gist Principles, Global Risk Perceptions) and Verbatim (Specific Risk Perceptions, Quantitative Risk Perceptions) Measures for the Adolescent Age Group*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Measure | Past online risk taking: Sharing personal information | Past online risk taking: Making unknown friends | Online risk intentions |
| Gist | Categorical risk  | .004 | -.066 | -.270\*\* |
|  | Gist principles | -.35 | -.074 | -.369\*\* |
|  | Global risk perception | -.005 | -.082 | .024 |
| Verbatim | Specific risk perception | .031 | .040 | .350\*\* |
|  | Quantitative risk perception | .073 | -.050 | .150 |

\**p*<.05. \*\**p<*.01

Table 4

*Correlations of Past Online Risk Taking and Online Risk Intentions Variables with Gist (Categorical Risk, Gist Principles, Global Risk Perceptions) and Verbatim (Specific Risk Perceptions, Quantitative Risk Perceptions) Measures for the Young Adult Age Group*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Measure | Past online risk taking: Sharing personal information | Past online risk taking: Making unknown friends | Online risk intentions |
| Gist | Categorical risk  | -.092 | -.033 | -.257\*\* |
|  | Gist principles | -.092 | -.175\* | -.443\*\* |
|  | Global risk perception | -.031 | .029 | .069 |
| Verbatim | Specific risk perception | -.023 | .052 | .135 |
|  | Quantitative risk perception | .078 | .138 | .033 |

\**p*<.05. \*\**p*<.01

Table 5

*Results of Principle Component Analysis for the Gist and Verbatim Measures (N=292)*

|  |  |
| --- | --- |
| Item | Rotated factor loading |
|  | Gist component | Verbatim component |
| Categorical risk (Gist) | .83 | .02 |
| Gist principles (Gist) | .80 | -.07 |
| Global risk perception (Gist) | .51 | .31 |
| Specific risk perception (Verbatim) | .03 | .85 |
| Quantitative risk (Verbatim) | .06 | .85 |
| Eigenvalue | 1.76 | 1.38 |
| Percentage variance | 35.24 | 27.66 |

Table 6

*Results of Hierarchical Regression Analysis Predicting Online Risk Intentions*

|  |  |  |
| --- | --- | --- |
| Step | Independent variables | Online risk intentions |
|  |  | *β* | *t* | ∆*R*2 |
| 1 |  |  |  | .15\*\* |
|  | Age | -.16 | -2.79\*\* |  |
|  | Sharing personal information | .24 | 4.24\*\* |  |
|  | Making unknown friends | .26 | 4.39\*\* |  |
| 2 |  |  |  | .34\*\* |
|  | Age | -.19 | -3.66\*\* |  |
|  | Sharing personal information | .21 | 4.04\*\* |  |
|  | Making unknown friends | .21 | 3.99\*\* |  |
|  | Gist component | -.36 | -7.07\*\* |  |
|  | Verbatim component | .26 | 5.07\*\* |  |
| 3 |  |  |  | .40\*\* |
|  | Age | .01 | .09 |  |
|  | Sharing personal information | .24 | 2.40\* |  |
|  | Making unknown friends | .16 | 3.16\* |  |
|  | Gist component | -.34 | -4.38\*\* |  |
|  | Verbatim component | .35 | 4.79\*\* |  |
|  | Sharing Personal Information × Age | -.09 | -0.87 |  |
|  | Making Unknown Friends × Age | .31 | 5.10\*\* |  |
|  | Gist Component × Age | .01 | .09 |  |
|  | Verbatim Component × Age | -.16 | -2.16\* |  |

\* *p*<.05. \*\* *p*<.01

Figure caption

*Figure 1.* Interaction between verbatim component and age predicting online risk intentions for adolescents and young adults.

*Figure 2.* Interaction of number of unknown friends made online in the past 12 months and age predicting online risk intentions for adolescents and young adults.

Figure 1

Figure 2