Social Contexts and Responses to Risk Network (SCARR)

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Investigating Naturalistic Decision-Making Using Computerized Diaries

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1. Introduction

The SCARR project at Oxford University investigates the role of interpersonal emotion in risky decision making. In particular, our aim is to find out when and how interpersonal emotions influence decision-making under conditions of uncertainty.

When a person encounters a decision situation, both perception of the degree of risk and evaluation of possible courses of action may be influenced by this person's own mood and emotions (e.g. Loewenstein, et al., 2001; Hockey, et al., 2000). However, when someone else is present, that other person's verbal reactions and nonverbal expressions of emotion may also have an impact on the decision-making process. The other person's emotional reactions can help the decision-maker to make sense of decision alternatives or give an idea of how this person appraises the risks involved. Alternatively, the other person's emotion may affect the decision-maker's emotion more directly (e.g., by emotion contagion). In our research, we use a range of methods to untangle these processes, but the current working paper focuses on just one of these, namely a computerized event-sampling method.

Previous research into the impact of individual emotions and mood on decision making has relied heavily on experimental laboratory settings. During these experiments, participants are generally exposed to an artificial decision situation (e.g. a gambling task), often after a specific mood induction (e.g. Isen & Geva, 1987; Mittal & Ross, 1998; Yuen & Lee, 2003). Even when hypothetical real-life events are used (e.g., Hockey et al., 2000), participants do not experience the direct consequences of their imagined decisions and their level of personal involvement typically remains at a relatively low level. Similarly, any induced or naturally occurring affective states whose impact on decision-making is assessed in these studies is unlikely to have a direct bearing on the decisions being made.

Although laboratory-based research of this kind certainly contributes to our understanding of risk-taking behaviour, risky decision making and the effect of emotion on the decision-making process, its use of standardised scenarios or decision tasks with no direct relevance to participants' lives outside the laboratory limits applicability to everyday decision-making in more realistic settings. In short, there are issues of ecological validity.

A few researchers have asked participants to report on real-life decisions and/ or risk-taking behaviour as they actually unfolded rather than exposing people to artificial decision-making situations in the lab. For example, Shapiro, Siegel, Scovill, and Hays (1998) asked college-age women to keep

a diary of risk-taking behaviours over the course of a week and to record their reasons for engaging in these behaviours. More research of this kind is needed to understand the everyday contexts for and consequences of risk-related events. It is also important to assess how responses to these contexts and experience of these consequences might differ for different people or groups of people.

People vary as to what they perceive as risky in their day to day lives; what type of decisions they perceive to have an impact on their own life or that of others as well as to how and when their own feelings and emotions and those of (important) others influence their decision making. For example, interviewees in our research have differed in their perceptions of the riskiness of purchase decisions. Some say that their comfortable financial situation removes any risk from purchases, whereas others feel that any purchase is potentially risky because the money is always needed elsewhere. Thus degrees of perceived risk and anxiety may depend on socio-economic as well as psychological factors. Studies looking at real life behaviours and experiences, such as the diary study conducted by Shapiro and colleagues (1998) are able to take into account these interpersonal differences in sensitivity to different kinds of risk.

The Shapiro study is an example of a study that uses diary or experience-sampling methodology (ESM). These terms are used to denote research where participant report their experiences during their day to day life (in situ) often in response to a signal (that may occur at random or preset times). In addition to allowing us to investigate interpersonal differences in sensitivities to risk domains, using ESM to complement more controlled experimentation permits us to take into account the context in which the risky decisions are occurring as well as the variability of decision making behaviour in relation to context. ESM approaches are well suited for addressing questions concerning daily experience especially those that take the form: “do fluctuations in X covary [over time and across participants] with fluctuations in Y?” (Alliger & Williams, 1993, p 526), as well as disentangling the relative contributions of, and interactions between, person-related and situational variables. In short, the methodology is particularly appropriate when the phenomena under investigation have a temporal structure and that can vary between as well as within persons.

There are three main ways of sampling experience in diary studies (Wheeler & Reis, 1991). The first involves *signal-contingent* recording, where a signal prompts data entry at random times during participants’ lives (e.g., Larson & Csikszentmihalyi, 1978). Such a method is useful for sampling the range of

activities and events that individuals experience but may miss out on rarely occurring experiences. *Interval-contingent* recording involves regular data entry at set time periods, thus facilitating the mapping and modelling of temporal patterns in fluctuating processes. For example, diurnal or longer-term rhythms in alertness and mood can be detected using this kind of method given frequent enough time-sampling (e.g., Totterdell et al., 1994). Finally, *event-contingent* recording involves instructing participants to enter data whenever a pre-specified class of event occurs in their lives (e.g., a risky decision). Such a technique allows investigators to obtain in-depth information about particular kinds of experience and the events that precede their occurrence.

Diary methods have been used in several fields of research. The Shapiro study (described above) is a good example of event-contingent recording in the domain of risk. Another example from the field of occupational and organisational psychology is Miner, Glomb and Hulin's (2005) computerized diary investigation of how events, mood and behaviours in the work setting vary over time.

In our own research, we used computerized diaries that collected event- and interval-contingent data concerning the influence of own and other people's emotions on real life risky decision making. Forty-one participants (15 males, 26 females) completed pre-programmed decision questionnaires using handheld PDAs (Personal Digital Assistants, or palmtop computers) whenever they made a non-routine decision which involved another person as witness, advisor, or co-decision-maker. Participants were asked to enter information describing the decision itself, the various options considered and the risk associated with each. They also rated their own and the other person's emotions and their respective influences on the decision process. Finally, we asked participants to complete mood scales at least once a day during the three-week study period, regardless of whether or not a relevant decision had been made. After completion of the diary phase, each participant discussed some of the decisions reported on the handheld computer in further detail during a one-hour, semi-structured, interview. Feedback on the use of the equipment and software was also solicited at this stage.

The following sections of this paper discuss experience-sampling methods in general with particular emphasis on computerized ESM. We will further discuss the equipment (handheld computers) and software (e.g. iESP) needed to deliver diary measures and describe how data are obtained and analysed. As an illustration of computerized ESM, we will provide further

details of our own recent diary study of interpersonal emotion and risky decision making. The current paper is by no means an exhaustive discussion of ESM and focuses specifically on the use of computerized ESM for decision research. Other sources discuss ESM, computerized ESM and the various options for hardware and software in further detail (e.g. Barrett & Barett, 2001; Conner, 2006).

2. Experience-Sampling Methods (ESM)

Experience Sampling Methods, which are also known as 'diary methods', 'daily process methods' or Ecological Momentary Assessment (EMA), have been used for many years (Conner, 2006). The term 'Experience Sampling Method' was coined by Larson and Csikszentmihalyi in 1978 (Larson & Csikszentmihalyi, 1978/1983). In general, ESM allows relatively in-depth study of everyday experiences and behaviours in their natural context (Hormuth, 1986). Data may be collected at either random or pre-determined times during the day (Miner et al, 2005). The time span for recall is therefore usually only a few hours and as a result the data are typically less subject to biases in recall of the target events, behaviours or feelings (e.g. Miner et all, 2001) than retrospective self-reports collected after more extended time intervals (see section 2.1 for a more detailed discussion of these advantages).

In its earliest use, the term ESM referred to random signalling of participants during their daily lives, although nowadays many researchers use the term to indicate a wider range of methods (Conner, 2006) also including the event- and interval-contingent signalling procedures distinguished above. In this paper, we use the terms ESM and diary methodology interchangeably.

2.1 Advantages and disadvantages of using ESM

A substantial proportion of available research into psychological phenomena relies on participants telling researchers what is going on in their lives, and describing what they are feeling or experiencing. These 'standard' self-report procedures suffer from certain disadvantages which can be alleviated by using ESM (Conner, 2006).

First of all, self-report methods are potentially susceptible to recall biases. Participants are often asked to report on events of the past week, month or even year which involves retrieval or reconstruction of these past experiences from memory. This cognitive process can be subject to a whole set of heuristics, implicit theories and motivations which in turn can lead to the participant remembering the experience or event incorrectly (Barrett & Barrett, 2001). These problems may be particularly acute when participants

have to recall fleeting emotional states and the often implicit appraisals that may have accompanied them (e.g., Parkinson & Manstead, 1992).

A second disadvantage is that most self-report questionnaires require participants to summarise their experiences from a certain period of time into a small set of responses on a questionnaire (Conner, 2006; Barrett & Barrett, 2001). For example participants might be asked how anxious they felt during the past week, when the week included a mixture of anxious and relaxed experiences of different intensities (e.g., Diener et al., 1985).

A third potential disadvantage arises from the fact that these self-report questionnaires are very rarely completed in comparable situational contexts to those in which the described events originally took place. Often participants are required to recall their experiences from a detached standpoint in a research laboratory where none of the contextual details surrounding whatever happened are available to help in reconstruction of an accurate narrative.

Despite the fact that ESM too is a form of self-report, it is less influenced by some of these recall and reconstruction biases. Because participants typically enter data frequently (i.e. whenever the beeper sounds or whenever a certain event or experience occurs), the interval between experience and recall is usually brief. Further, most diary methods do not require participants to aggregate their experiences into any summarized report. In event-contingent ESM studies particularly, participants answer questions whenever pre-specified events occur, and participants are only asked about events that they have just experienced. Finally, most ESM studies permit participants to record their experiences in the context in which they happened.

Other (methodological) advantages include the fact that ESM allows researchers to develop predictive models of changes in behaviour over (short) time periods. The methodology makes it possible to include time as a predictor variable in multilevel modelling (see below) and time series analyses (Barrett & Barrett, 2001). It further permits researchers to study behaviours and experiences that cannot be investigated in the laboratory due to issues of practicality or ethics.

Of course, ESM also brings some disadvantages. It can be very time-consuming for the researchers as well as expensive, particularly when computerized ESM is used (see next section). Involvement in an ESM study also typically requires high levels of co-operation from participants and a willingness to sacrifice a great deal of time and effort (Miner et al., 2001).

Above all, ESM involves repeated intrusions in participants' lives (Alliger & Williams, 1993).

A further potential disadvantage is that repeated self-reporting of particular behaviour or experiences might itself lead to changes in those behaviours or experiences. Strategies for minimizing this kind of *reactivity* include sampling more than one type of experience and excluding participants who might be motivated to change the behaviour under investigation (unless ESM is being used as a means of intervention; Conner, 2006).

In our recent diary study detailed below, we encouraged event-contingent recording, although participants were also reminded by a daily alarm to think about any decisions they made that day. Participants therefore only had to remember reportable events for a maximum of 24 hours. Giving participants the chance to complete the questionnaires in the evening as well as whenever the event (i.e. relevant decision) occurred (event-contingent recording) meant that participants did not have to complete the questionnaire at inconvenient times, such as during work meetings or study time, increasing their willingness both to participate and to record all relevant decisions. However, this procedure also brought the unwanted consequence that participants could wait up to 24 hours (i.e. until the next reminder signal) before completing the questionnaire about a particular decision, thus potentially undermining the accuracy of their memory.

2.2 Computerized ESM

In the past, participants in ESM studies had to carry a beeper or pre-programmed watch as well as paper copies of all relevant diary measures. They were asked to complete questionnaires whenever the beeper was activated, which could be either at random or preset times (Alliger & Williams, 1993). Although such procedures are still relatively common, these days many researchers both deliver signals and collect data using handheld electronic devices (Personal Digital Assistants or PDAs).

Computerized ESM brings additional advantages over more traditional pencil-and-paper methods. First, it permits tight control of the timing of data collection (i.e. when questionnaires are presented), and allows researcher to specify more precise time windows during which participants have to respond to measures (Barrett & Barrett, 2001). Previously, researchers needed to collect paper questionnaires at frequent intervals in order to ensure that data were recorded at the required times rather than retrospectively. With computerized ESM, an automatic record is kept of any missed questionnaires as well as the time and date of each separate entry.

Another advantage of computerized ESM is the reduction of human error during data entry prior to statistical analysis. The data can simply be transferred from the PDA to a desktop computer, and can be saved directly in a format which is recognized by statistical software such as SPSS or SAS (Barrett & Barrett, 2001).

A final advantage of using PDAs for data collection is that it can reduce the reluctance participants might otherwise feel about participating in a demanding diary study. In line with Barrett and Barrett's (2001) observations, we have found that participants are often enthusiastic about the use of handheld computers, making the recruitment process a little easier and compliance more likely.

On the other hand, one of the practical disadvantages of computerized ESM is the time required to set up studies, including the installation of necessary software on each handheld and the creation and downloading of questions (Barrett & Barrett, 2001). Retrieval and transfer of data from PDA to PC can also be time-consuming, and format conversion is not always straightforward. Another downside is the cost of the equipment which can be quite substantial, and which can include the replacement of missing parts such as stylus and chargers, and repair of the handheld, in addition to its initial purchase. Insurance against loss or theft is also advisable to offset the possible cost of replacement of hardware.

Barrett and Barrett (2001) also mention the potential problem that participants might try and use the handheld for purposes other than data entry, thus reducing battery life and potentially interfering with the activation of questionnaires and recording of responses. In our study this was not such a serious problem because we did not expect participants to access the handheld too often during the day. In fact, we did allow our participants to make use of the handheld's other facilities, but warned them not to access the 'memos' function and 'set-up' of the program that offered the questionnaires, explaining how this would affect the running of the study. We also provided them with chargers in case the batteries ran low. No problems occurred and the fact that we allowed participants to 'treat the handheld as their own' seemed to increase participants' motivation to volunteer for, and complete the study.

3. Equipment and software

3.1 The iESP software

The diary measures in our study were delivered using iESP software on a PalmOne Tungsten T5 handheld computer with a PalmOS 5.4 operating

system. Various alternative forms of hardware and software are available (e.g. Conner, 2006, for a discussion) but in the current paper we will focus on this particular implementation. iESP was built by researchers at Intel Research Seattle and the University of Washington Computer Science and Engineering Department[1] using existing software called the Experience Sampling Program (ESP) as its base code. ESP was developed at Boston College by Dr. Lisa Feldman Barrett and Daniel J. Barrett (see also Barrett & Barrett, 2001). Both ESP and iESP software are specifically designed for running ESM on handheld computers and iESP works with Palm-compatible handheld computers running PalmOS version 3.5 or higher**.** ESP and iESP are both open-source software programmes, freely available to download from http://www.experience-sampling.org/esp/ (ESP) and http://seattleweb.intel-research.net/projects/ESM/iESP.html (iESP).

3.2 Creating the diary measures on the handheld

The iESP software presents the respondent with questions that are created and stored in the Palm's Memo Pad software. Each question is described by an individual memo, and contains the question number and a code for the answer mode (e.g. buttons, sliding scale, text) for that particular question. For example, the memo *"04|Please describe the decision situation, keeping in mind that you can describe the different options in some detail later on: %Type Text",* creates an open-ended question and participants have four lines to describe the decision on the handheld's touch screen as can be seen in **figure 1**.

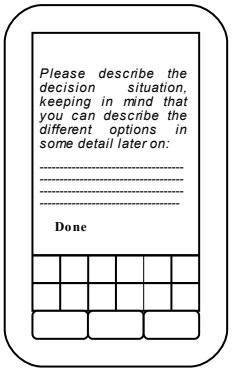

Figure 1. *Example of a question with the free-text answer mode.*

[1] Sunny Consolvo, Miriam Walker, Rahul Shah of Intel Research Seattle & Micah Z. Brodsky of the University of Washington's Computer Science & Engineering department.

Questions may be presented either in a random order or following the particular sequence specified by the question numbers. Using the latter method, it is also possible to exclude questions on the basis of previous answers. For example the memo: *"20|Have you any idea how this person felt when you were faced with the decision and when you finally made it? %Type buttons|Yes |No %NEXT 27",* creates a question with two answer buttons marked 'yes' and 'no'. If the participant taps 'yes' in answer to this 'router' question, (s)he will be offered questions 21-26 about the other person's emotions. If the participant taps 'no', (s)he will skip these questions and go straight to question 27.

3.3 Running the iESP software on the handheld

The iESP software can be set in 'automatic' or 'manual' mode, or in some combination of the two. In automatic mode, the software 'takes over' the handheld and automatically offers the participant a questionnaire at set times or at random times throughout the day with the participant completely locked out of most of the Palm features. In manual mode, the questionnaire can simply be accessed by the participant whenever the pre-specified event occurs by tapping the iESP symbol on the handheld (event-contingent recording) and the participants has access to all other functions on the handheld. As indicated above, the latter was the main method used in our research and participants could access the questionnaire whenever they made a decision fitting study criteria, although they were also reminded about the questionnaire at least once a day by an alarm.

3.4 Transferring data from the handheld computers

In order to transfer data from the handheld, a separate programme, iESPview is used. iESPview is again a modified version of a programme designed to upload handheld data collected using the original version of ESP (ESPview written by Daniel Barrett). iESPview takes the Palm database file (pdb format) containing the questionnaire entries and imports them in a format that can be read by Microsoft Excel or Microsoft Access (for an example, see **table 1**) and that in turn can be read into SPSS files. Alternatively, text files containing the data can be created.

Apart from the time required, the only other drawback we experienced while completing this process in our study was that each participant's data for each time-point was entered on separate rows rather than in columns on the data sheet (see **table 1**). In order to generate a usable SPSS file, we needed to transpose the data in the files.

Table 1. *Portion of one fictional decision entry for participant 4 (Excel spreadsheet).*

Date	time	PP	Q	ticks	A	type	Text
01/24/2006	18:20:27	4	3	2725819	1	list	a) YES
01/24/2006	18:20:27	4	4	2726205	2	list	b) during the same day
01/24/2006	18:20:27	4	5	2736587	-1	text	Whether to buy a house
01/24/2006	18:20:27	4	6	2736886	45	slider	
01/24/2006	18:20:27	4	7	2756636	42	slider	
01/24/2006	18:20:27	4	8	2757732	1	list	a) 2 different options
01/24/2006	18:20:27	4	9	2760419	-1	text	Buy the house I have seen
01/24/2006	18:20:27	4	10	2760822	1	list	a) self

Please note: Date = date of the entry; Time = time participant started to make the entry; PP = participant id; Q = question id as noted in the memos function; ticks = response time; A = answer (-1 if the answer is text); type = type of answer mode; Text = any text associated with the answer (either free text entry or a label).

3.5 ESM Data analysis

In ESM participants repeatedly report on their experiences on several occasions. The procedure therefore generates data that permit both between-subjects and within-subjects comparisons (i.e. participants can be compared with one another and time periods can be compared with one another, Barrett & Barrett, 2001). Statistical analysis using a random coefficient multilevel modelling procedure (e.g. Hierarchical Linear Modelling (HLM); Raudenbush & Bryk, 2002) allows researchers to model the influence of both within-subject and between-subject factors simultaneously on an outcome variable (Barrett & Barrett, 2001).

Data will typically be organised on two or more levels with participant characteristics on level 2 and participants' repeated diary measures (nested within participants) on level 1. Most ESM studies require participants to make entries over an extended period of time, normally a few weeks. Time can therefore be used as an (additional) predictor variable (Barrett & Barrett, 2001). HLM has been successfully used by many previous researchers in the analysis of diary data generated using ESM (e.g. Totterdell, Wood & Wall, 2006).

In the fourth section of this paper, we will give a more detailed example of how we used computerized ESM to collect and analyse data in our own research. We will also report some descriptive findings to give readers a flavour of the type of decisions reported by our participants. We finish this

paper with a summary and some recommendations for future research using (computerized) ESM.

4. An example of computerized ESM: Risky decision diary study

4.1 Procedure

Forty-one participants aged between 18 and 52 (M = 27, SD = 7.8) took part in the study. The study was conducted in five waves with up to nine participants in each wave. On the one hand, this was purely a necessity as we only have 10 PalmOne Tungsten T5 handheld computers available at any one time, but on the other hand it offered some practical advantages. The limited numbers of participants in each group allowed us to provide more individualised briefings on the use of the handheld and completion of the questionnaire using only one investigator at a time. If certain difficulties came up in one group, additional instructions could be included for the next group as required. Further, a single researcher was able to deal with all the technical problems and queries on her own. Finally, all interviews could be conducted within one week of the participants handing in their handhelds, something which would have been practically impossible if 40 plus participants had completed the study on the same date. Participants from the various groups (waves) went through exactly the same procedure which we will briefly discuss below.

4.1.1 Introduction meeting. All participants attended an introduction meeting in small groups of two to four participants**.** During this one-hour meeting, participants were fully informed about the purpose of the study and the procedures involved, and were asked to sign consent forms. Participants received verbal and written instructions about the types of decisions they should and should not report on their handheld. Participants were further instructed to pass the handheld to a reference person (a person who was routinely involved in many of their decisions) whenever (s)he was available upon completing a decision questionnaire. In the second half of the introduction meeting, the use of the Palm handheld computers and the iESP software was explained. Participants were encouraged to try out the questionnaire and familiarise themselves with the equipment during this part of the meeting.

4.1.2 Completing decision questionnaires. Participants were required to keep the handheld with them for a period of three weeks and to complete the questionnaire whenever they made a non-routine decision which involved another person. Participants were expected to access the 'Risky Decision' questionnaire at least once every day, and were reminded of this by an alarm

at eight pm every evening. Even if they did not have a decision to record, they were still expected to complete the two mood scales every day.
After a three week period, participants returned the handheld computer to the department and the data were retrieved by connecting the handheld to a PC loaded with the relevant software.

4.1.3 Interview. The last part of the procedure involved each participant coming to the department for a one-hour, semi structured interview with one of the researchers. The interview was audio-recorded, with permission of the participant. Interviews were included in the procedure in order to clarify specific entries made by participants on the handhelds and to get feedback from the participants on using the handheld and completing the questionnaires. We also used the interview to get additional background information concerning some of the reported decisions. This in-depth discussion allowed for an exploration of the potential influence of other people's thoughts and emotions on the decision process.

If the participant was asked for a specific rating during the interview (e.g. the extent to which they had had contact with the other person about the decision on a scale from 0 *minimum contact* to 100 *maximum contact*), the interviewer would show the scale on a piece of paper to help the participant determine his or her answer.

4.2 Decision Diary Measure

Participants in our study accessed the 'Risky Decision' questionnaire on their handhelds whenever they had a relevant decision to report. This questionnaire is divided into six different sections. Whether a certain part or question is completed by the participant, depends on the answers to specific 'router' questions as shown in **table 2**.

Table 2 gives a more detailed overview of the structure of the questionnaire as a whole and of the specific questions as well as answer modes which were used (multiple-choice, sliding 100-point rating scale and free text entry). The last part of the questionnaire was only completed if the reference person was available and willing at the time that the rest of the questionnaire was completed by the participant.

Table 2. *Overview of decision questionnaire*

Questions	***Answer mode***
Answered regardless of whether a decision has been made:	
Mood scales	
1. Please indicate how you are currently feeling (sad-happy)	Slider
2. Please indicate how you think your reference person is currently feeling (sad-happy)	Slider
3. Please indicate whether you want to describe a decision involving someone else (if respondent ticks no, the questionnaire ends here).	MC
Answered when an appropriate decision was made:	
Description of the decision and the various options	
4. When are you completing this questionnaire?	MC
5. Please describe the decision situation, keeping in mind that you can describe the different options in some detail later on	Text
6. How important was this decision?	Slider
7. Under how much time pressure were you to make the decision?	Slider
8. How many options could you choose from? (Depending on the answer of the respondent the following questions are repeated two or three times)	MC
1. Please describe option 1, the option you have chosen or you are most likely to choose/ Please describe your second option, the option you considered most seriously apart from your preferred final choice/ Please describe your 3rd option	Text
2. Did this option involve risk to self; other(s); self and other(s) or nobody	MC
3. How risky did you perceive this option to be?	Slider
4. Please describe the possible negative consequences of this option.	Text
5. The negative consequences can be classified as financial; emotional/social; physical; a combination of these; other negative consequences or no negative consequences.	MC
6. While you were making the decision, how likely did you think it was that these negative consequences would happen?	Slider
9. How much time passed between first thinking about the decision and finally deciding?	MC
Own emotions	
10. How excited were you when you first thought about this decision?	Slider
11. How anxious (worried, concerned) were you when you first thought about this decision?	Slider
12. How excited were you when you had made the decision?	Slider
13. How anxious (worried, concerned) were you when you had made the decision?	Slider
14. Please indicate to which extent you were trying to hide your feelings about this decision?	Slider
15. To which extent was your decision influenced by your feelings at the time?	Slider
Involvement other person	
16. What was the role of the other person involved in this decision? (the person most important for the decision)	MC
17. Is this the same person as your nominated reference person? (If respondent ticks no, (s)he is asked to identify the person in the next question).	MC
1. This person was my partner/spouse; family member; close friend; acquaintance; someone else.	MC
18. Did you talk to this person about the decision before you made it?	MC
19. Please indicate the level of contact you had with this person during the course of the decision making process (i.e. between being confronted with the decision and finally making it)	Slider
20. Have you got any idea how this person felt when you were faced with the decision and when you finally made it? (If yes, the questionnaire continues, if no the questionnaire skips the following questions 21-27)	MC

Feelings other person

21.	How excited was this person when you were faced with the decision situation?	Slider
22.	How anxious (worried, concerned) was this person when you were faced with the decision situation?	Slider
23.	What made you think that he or she felt this way?	MC
24.	How excited was this person when you finally made the decision?	Slider
25.	How anxious (worried, concerned) was this person when you finally made the decision?	Slider
26.	What made you think that he or she felt this way?	MC
27.	Please indicate to which extent you think this person was trying to hide their feelings about this decision from you	Slider
28.	Was there any indication that this person was trying to influence your decision in any way?	MC
29.	To what extent did the other person's feelings about the decision influence your consideration of the options?	Slider

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Completed by the reference person if (s)he is available at the time that the rest of the questionnaire is completed:

Reference person

30.	Is your nominated reference person available? (If the respondent answers yes, (s)he is asked to hand over the handheld to the reference person who is asked to answer the following questions; if no, (s)he is asked to check in again when they have a decision to report)	MC
	1. Please indicate how you are currently feeling (slider from sad-happy)	Slider
	2. Please indicate how you think the other person (your partner/ friend/ family member) is currently feeling (slider from sad-happy)	Slider
	3. Are you aware of the decision the other person had to make/has to make? (If yes, some more questions follow, if no, questionnaire ends)	MC
	1. How excited were you when you first heard about this decision?	Slider
	2. How anxious (worried, concerned) were you when you first thought about this decision?	Slider
	3. How excited were you when the decision was made?	Slider
	4. How anxious (worried, concerned) were you when the decision was made?	Slider
	5. Please indicate to which extent you were trying to hide your feelings about this decision from the other person?	Slider
	6. Did you try to influence the other person's decision?	MC

Please note: Slider = a rating scale from 0-100 (e.g. 0 = *not at all* to 100 = *extremely*). Participant taps anywhere on the sliding scale to indicate his or her rating; MC = multiple choice. Participant either taps one of the buttons or picks the relevant answer from a list; Text = open ended question, typed reply expected.

4.3 Analysis

Data were analysed both at a descriptive level (e.g. what kind of decisions do people report? What type of negative consequences do these decisions have?) and by using statistical techniques which allowed us to look for predictors of both the perceived risk and perceived importance of decisions. We anticipated that these outcome variables would be influenced by such factors as the participant's own experienced emotion and the perceived emotion of the other person as well as certain interpersonal factors.

The data had a hierarchical structure, with decisions (level 1) nested within participants (level 2). The diary questionnaire entries (decision description,

perceived risk, experienced emotions etc) formed the decision-level data whereas the rest of the questionnaire data (Demographic measures) and certain overall diary measures (e.g. number of total entries made by a specific participant) constituted the participant-level data (level 2). The main analysis used the HLM 6.03 statistics programme (Raudenbush, et al., 2004) to construct a multilevel linear model of the data.

4.4 Findings

A discussion of the specific findings of these statistical analyses is beyond the scope of the present working paper. In the following, we will give a brief overview of some of the more descriptive data.

4.4.1 Response rate. A total of 698 entries were made on the handheld computers by the 41 participants. Of these entries, 321 entries comprised only of ratings on the two mood scales (i.e. no decision was made). A further 349 entries consisted of completed decision questionnaires, whereas in an additional 28 cases the participants broke off from completion of the decision questionnaire at some point. From these latter entries only the two mood scales were used. For 232 of the 349 complete decisions (across 39 participants), the participant indicated that (s)he was aware of the feelings of the other person involved. These participants and their 232 decisions were the main focus of the hierarchical analyses.

The response rates highlight a problem we encountered with compliance to the study procedure. Although most participants apparently did record all their relevant decisions, many participants forgot (or were unwilling) to complete the two mood scales at least once a day, irrespective of whether they had a decision to report. If every participant had completed at least one entry a day for the full 3 weeks of the study we would have a minimum of 861 entries rather than the 698 we currently have.

4.4.2 Type of decisions reported. The types of decision reported in the current study can be broadly classified using participants' reports of the possible negative consequences of the various options. **Figure 2** gives several examples of decisions for which the consequence of one or more options fall in one of the main categories (i.e. emotional/social consequences; financial consequences, physical consequences, other negative consequences, no negative consequences or a combination of consequences). **Figure 2** also shows percentages of participants who classified the potential negative consequences of their chosen option in one of the categories.

The decisions varied in their importance rating, with a mean aggregated score of 59.14 (SD = 12.60) on a 100-point rating scale where 0 was not important at all and 100 was extremely important. The chosen option (option 1) was considered to be moderately risky (M= 43.23, SD= 15.43; mean aggregated score).

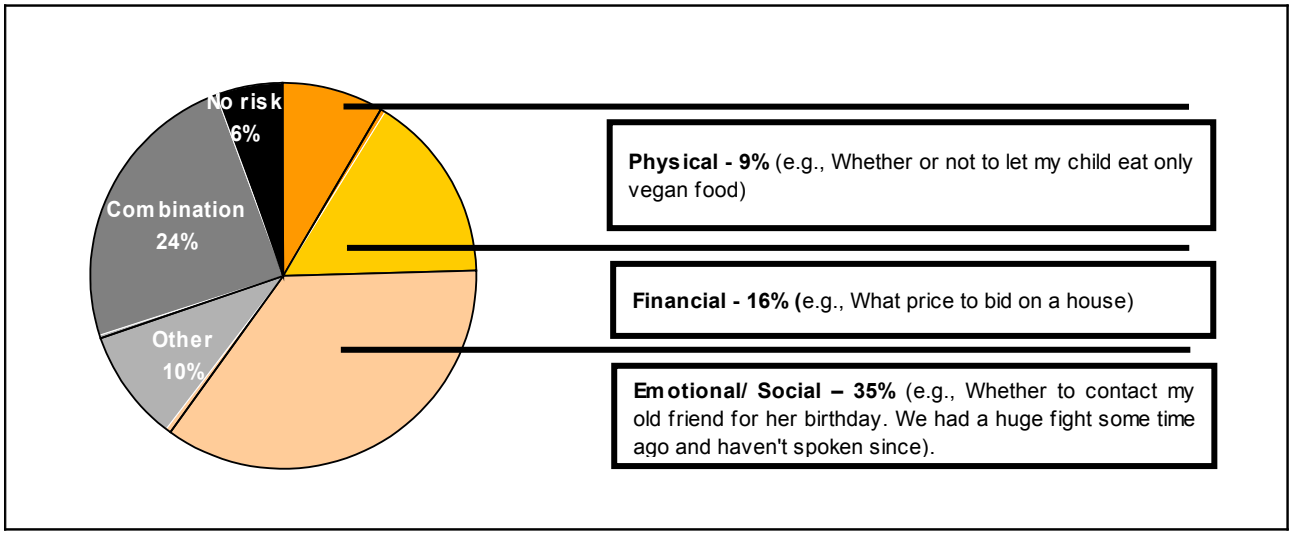

Figure 2. *Examples of decisions reported whilst using computerized ESM*

Forty-one percent of the reported decisions were joint decisions with the other person involved in the decision, whereas for 29.2% of decision the other person acted as advisor. For the remaining decisions the role of the other person was either described as 'a mere bystander/witness' or 'other.' In 60.2% of the cases the other person involved was also the reference person nominated by the participant at the beginning of the study.

5. In conclusion

Our own experiences using computerized ESM have been mainly positive. In summary:

- The methodology seems suitable to study real life experiences in general and the real life 'risky' decisions we are interested in, in particular.
- The collected data allow us to model influence of both within- and between-subject factors simultaneously on a given outcome variable when using the correct analysis procedures (e.g. HLM).
- It allows us to study experiences and situations we cannot easily elicit in the lab.
- It helps to avoid problems with recall of experiences and events. In our own research, this advantage becomes particularly clear when we compare the entries on the handheld and the answers some participants

gave during the interview which took place some time later. Although most remembered the occasion in question, several participants could no longer remember the emotions they experienced or the reactions of the other person involved. Whereas they had made these entries on the handheld with no reported problems.

- Computerized ESM offers the possibility of precise timing (controlling when entries are made on the handheld). Although we did not use this possibility in our study, we did explore the possibilities.
- Computerized ESM records the exact time and date when data are entered, making it possible to exclude entries that are made retrospectively. In our study we excluded two participants because they had clearly entered information relating to all of their decisions on the last day of the three-week study period!

5.1 Some 'user tips'

Finally, if you decide to use computerized ESM for your own research, we would suggest you consider the following:

- Leave plenty of time to design your diary measure. It took us a while to get used to the use of iESP and what types of question were practical.
- Even if you use a pre-existing pencil-and-paper measure as the basis of your 'computerized' questionnaire, try the questionnaire out on a few colleagues once you have adapted it to check that it actually works. Certain features of iESP dictate the way in which questions can be asked. For example, any free text entry for answers is restricted to 4 lines on the screen. It might therefore be necessary to break down more complicated questions into shorter ones.
- Only instruct small groups of participants in the use of the handheld and iESP at any one time and run the study in waves of participants. This will keep the cost down (you need fewer handhelds) and it is easier to monitor participants and deal with any problems.

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