



# A study of involuntary autobiographical memories: Comparing paper and electronic diary methods

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## Abstract

The use of smart phones, particularly Apple iPhone and Android devices, is growing rapidly and the users typically carry and access them at all times. Because they can be programmed to store both free text and structured data (scores, ratings, dates and times), they present an ideal medium for diary studies where near real-time participant initiated, or prompted data recording is required. We have developed phone apps to use in place of paper diaries for recording a variety of everyday memory phenomena. In this study, we compared the paper and electronic diaries of Involuntary Autobiographical Memories (IAMs) that spontaneously occur in everyday life, often in response to external and internal cues. iPhone and Google Android phone users were randomly allocated to keep a diary of IAMs, using either an app on their smart phone or on paper. The third group was comprised of non-smart phone users keeping a paper diary of IAMs. Participants had to complete a 12-item questionnaire, for a seven-day period, every time they experienced an IAM. At the end of the study, they also completed a short questionnaire measuring their compliance. We report findings comparing paper and smartphone diaries in terms of compliance, the nature and quality of data recorded, as well as users' comments/feedback on the experience.

## Diary Method in Involuntary Autobiographical Memory Research

Involuntary Autobiographical Memories (IAM) pop into mind without any deliberate attempt to retrieve them. The majority are triggered by cues in one's environment or internal thoughts (Berntsen, 1996, 2010).

For research in this area the diary method still remains a key tool even though attempts have been made to study IAMs in the laboratory (Ball, 2010; Mace, 2006; Schlagman & Kvavilashvili, 2008).

### Some problems with paper diaries, however, include:

- Recruitment issues (motivation needed to join)
- Cumbersome – they need to be carried with a pen at all times
- They can be forgotten, not at-hand when needed, or lost
- Carrying a diary involves an additional *prospective* memory task to remember to carry the diary on oneself during the day.
- It is difficult to determine compliance of diary keeping
- It is virtually impossible to eliminate cheating or prevent delayed responses ("backfilling") or revisiting to enhance the entry

## e-Diaries on Smart Phones

In recent years various electronic devices such as Palm Pilots, PDAs and bespoke devices have been used to collect diary data.

### Up to now the limitations have included:

- Expense – cost of the device and custom programming
- Devices bulky and carried for a specific purpose
- Carrying the device an additional *prospective* memory task
- Inventory management – loan, support and retrieval of the device

### Changes with the advent of smartphones:

- Two very widely used platforms – **iPhone**, and **Android**
- Powerful devices with computing power, local data storage, camera (photo and video), microphone, location awareness and Internet connectivity
- **Participants effectively provide their own hardware** and tend to **carry and access it at all times**

### However, they are not perfect:

- Battery life is poor (sometimes < one day)
- Occasional unpredictable behaviour, e.g. loss of data
- Remote support is difficult and expensive
- Cost of developing software greater than printing paper forms
- Researcher is not in control of the device (e.g. other apps, factory resets, technical failure, operating system upgrades)
- Ethical and privacy implications (remote consent, security of data)
- Internet connection may cost participant money
- Any psychology app the researcher adds must be robust to ensure it does not affect the performance or integrity of the smart phone

## Aim of the Study

To compare the nature and frequency of Involuntary Autobiographical Memories (IAMs) recorded on a smart phone diary app and in a paper diary.

## Method

### Participants

Participants were university students and staff (mean age=24.2, SD=8.1, range=18-51). A total of 58 **iPhone** and **Google Android phone users** (collectively defined as smartphone users) were randomly allocated to keep a diary of IAMs using **either an app** on their smartphone (N=28) or **on paper** (N=30). The **third group** (N=17) comprised of **non-smartphone users** keeping a paper diary of IAMs.

### Materials

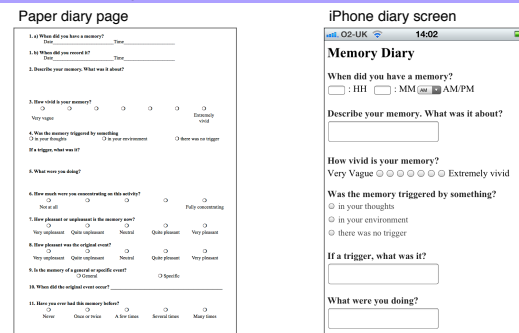
Participants in the standard paper diary group were given a 32 page A5 diary booklet to carry with them.

Participants allocated to the phone diary group had a "Memory Diary" app, developed by the authors, installed on their smartphone for the period of the study. The phone app form in this study was designed to look as similar as possible to the paper diary to avoid the suggestion that the phone app is more compelling to use (see Figure 1).

### Procedure

Participants kept a diary for seven days. They were asked to complete a 12-item questionnaire as soon as possible every time they experienced an IAM. If completing the questionnaire was not convenient (in a meeting, driving etc.), participants could tick a box (paper) or press a button (phone) later, simply acknowledging the IAM occurred. At the end of the study they completed a short feedback questionnaire.

Figure 1: Paper diary page, and equivalent screen on an Apple iPhone



## Technical Considerations

Data are stored on the phone during the seven-day study and only transferred to a database when participants return at the end of the study. As such, **the diary can be used at any time even away from networks**, e.g. on an underground or subway train. Data can be retrieved from phones in a WiFi environment to avoid any data charges to the participant.

### App Design considerations:

- Quick to start (icon on home screen)
- No logon required
- No network access or GPS signal required
- No validation of input (although numeric fields offer a numeric keypad)
- Big button for quick acknowledgement of IAM without recording details.

The date and time that the memory is entered on the phone is recorded using the phone's clock. Participants were not made aware of this.

## Results

1. No differences were found between non-iPhone paper diary group and iPhone e-diary group. But the iPhone paper diary group recorded significantly more IAMs than the other two groups (Table 1).
2. No group differences were found in terms of length of memory descriptions and other memory characteristics (Tables 2 and 3).
3. Significant group differences in compliance were found between the e-diary group and the two paper diary groups (Table 4). No-one forgot to carry their smartphone diary in the iPhone e-diary group.

Table 1: Number of memories recorded, by group

	Non-iPhone Paper (N=17)	iPhone E-diary (N=28)	iPhone Paper (N=30)	F (2, 72)	$\eta^2$
Fully recorded memories	12.24 <sup>a</sup> (6.90)	8.25 <sup>a</sup> (4.80)	16.97 <sup>b</sup> (8.20)	11.92	.25
Acknowledged memories	5.82 <sup>ab</sup> (8.16)	4.18 <sup>a</sup> (3.93)	9.67 <sup>b</sup> (9.99)	3.72	.09
Total Recorded Memories	18.06 <sup>a</sup> (13.65)	12.43 <sup>a</sup> (7.08)	26.63 <sup>b</sup> (13.81)	10.80	.23

Table 2: Number of words in memory description, by group

	Non-iPhone Paper (N=17)	iPhone E-diary (N=28)	iPhone Paper (N=30)	F (2, 72)	$\eta^2$
Word count	14.81 (8.23)	14.84 (9.99)	13.77 (5.92)	.15	.00

Table 3: Summary of Other Measures

- Percentage of specific memories
  - Pleasantness (1=very unpleasant, 5=very pleasant)
  - Vividness (1=Very vague, 7=Extremely vivid)
  - Concentration (1=not at all, 5=Fully concentrating)
- Non-significant (All Fs < 1.85)

Table 4: Number of days diary was forgotten

	Forgot Days				Total
	0	1	2	3	
Electronic Diary	29	0	0	0	29
	100%	0%	0%	0%	100%
Paper Diary Basic phone	12	3	0	3	18
	66.7%	16.7%	0%	16.7%	100%
Paper Diary iPhone	20	5	4	2	31
	64.5%	16.1%	12.9%	6.5%	100%
Total	61	8	4	5	78
	78.2%	10.3%	5.1%	6.4%	100%

## Conclusions

- Compliance rate of actually carrying the diary is much better with smartphone
- Overall paper and e-diary are broadly comparable in terms of types of data recorded
- People think they will record more memories on iPhone
- Counter intuitively, iPhone users recorded more memories in a paper diary
- Further analysis of personality scores and smartphone usage experience will be undertaken to try to explain this observation
- Smart phones create an exciting future for diary research. Phones are consistently to hand whereas paper diaries are bulky, forgotten, in a bag or in a different room
- There are many opportunities to use phones for electronic diaries and other psychology tools in the real world (Miller, 2012). The audio, video and geolocation facilities will be explored in future studies

## References

- Ball, C. T. (2007). Can we elicit involuntary autobiographical memories in the laboratory? In J. H. Mace (Ed.), *Involuntary memory* (pp. 127-152). Malden, USA: Blackwell Publishing.
- Berntsen, D. (1998). Involuntary autobiographical memories. *Applied Cognitive Psychology*, 10, 435-454.
- Berntsen, D. (2010). The Unbidden Past: Involuntary Autobiographical Memories as a Basic Mode of Remembering. *Current Directions in Psychological Science*, 19(3), 138-142.
- Miller, G. (2012). The Smartphone Psychology Manifesto. *Perspectives on Psychological Science* 7, 221.
- Mace, J. H. (2006). Episodic remembering creates access to involuntary conscious memory: Demonstrating involuntary recall on a voluntary recall task. *Memory*, 14, 217-224.
- Schlagman, S. & Kvavilashvili, L. (2008). Involuntary autobiographical memories in and outside the laboratory: How different are they from voluntary autobiographical memories? *Memory and Cognition*, 36, 920-932.

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