Investigating Evidence of Mobile Phone Usage by Drivers in Road Traffic Accidents

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Background

- Recent UK government surveys estimate around 1.6% of drivers in England and Scotland use a hand-held mobile phone whilst driving [1].
  - Number of cars licensed for use on the road in UK – 35million [2].
  - Van drivers identified most often.
  - 17-29 key age group.

- Department of Transport states road deaths have increased by 1% in 2014 to 1730 [3].
- 192,910 road casualties reported for year ending September 2014 [3].

Sources:
1. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/406723/seatbelt-and-mobile-use-surveys-2014.pdf
2. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/302409/vls-2013.pdf
3. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401295/quarterly-estimates-jul-to-sep-2014.pdf

Background

- Why is mobile phone usage a problem…'**driver distraction**'.

- Restriction of sight; limiting the driver's ability to survey the road, potential obstacles or changes in traffic flow, since their line of vision is focused on the handset.
- Reduction of concentration levels and situational awareness.
- Slower reactions times during adverse events which could result in as much as a 50% reduction in response rates.
- Failure to maintain a high standard of driving etiquette, resulting in acts such as tailgating or improper road position.

The Law

- Since 2003, the use of a hand-held mobile device whilst driving is prohibited.
  - Hand-held – a device being in one's hand when observed.
  - Performing an interactive communication function.
    - SMS, Calling, sending data, **providing access to the Internet**.
    - Penalty – 3 points, £100 fine.

- An offence of death by dangerous driving?
  - Judged against the '**careful and competent driver**'
  - Do they use their mobile phone in any way whilst driving?
    - doubtful

Mobile Phone Usage

- Standard usage analysis.
  - Time and date messages/ emails were sent.
  - Time and date calls were made.
  - Internet History records.
  - Social media posts etc.

  - But what about activity which occurs on a handset but leaves less obvious traces on the device?
    - For example, Reading the headlines on a news-bulletin application?

Passive Activity

- Passive activity is coined to denote actions which leave behind a less obvious evidential traces.

- Examples:
  - Re-reading SMS in the inbox/sent folder.
  - Scrolling through a twitter feed.
  - Reading news articles on applications such as BBC News.
  - Simply activating the handset to view the dash-board of a device.

- Passive actions still distract a driver as their eye-sight is directed to the handset, not the road for a period of time.

Investigation

- Statistics indicate Android and iPhone devices are the two leading manufacturers.
- The investigation into the acquisition of evidence denoting passive activity therefore took place on both these platforms.

- Test Devices:
  - iPhone 4 – running iOS 7
  - HTC One – Kit Kat 4.4
- Test Kit:
  - Microsystemation XRY

iPhone Analysis

iPhone Analysis

- This investigation will focus on the iPhone's `CurrentPowerlog.powerlog (CPL)` system file, and the `PLArchive` directory, both located at `/var/mobile/Library/Logs/`.

- The CPL consists of system events on the handset.
  - Each entry is prefixed with an ‘attribute tag’ making it possible to scan the CPL for similar event types.

- The CPL runs for a 24 hours period.
  - Handsets usage can be profiled for activity.

iPhone Analysis

- The period in which the CPL covers is defined at the start of the file under the attribute `[Log]`.

- At the end of its logging period (rollover date), it is moved to the `PLArchive`.
  - Each CPL is placed within a `.gz` archive and its naming convention represents the starting date of the log (e.g. `PL_2014-08-04-`).
  - `PLArchive` does not store all of the CPL files, but after the limited experimentation, CPL archive entries were present for up to 3 weeks.

- **Further testing on newer iPhone devices where only a file-system extraction type was available through Cellebrite indicated that both the CPL and PLArchive files were only available when the device was jail broken.**

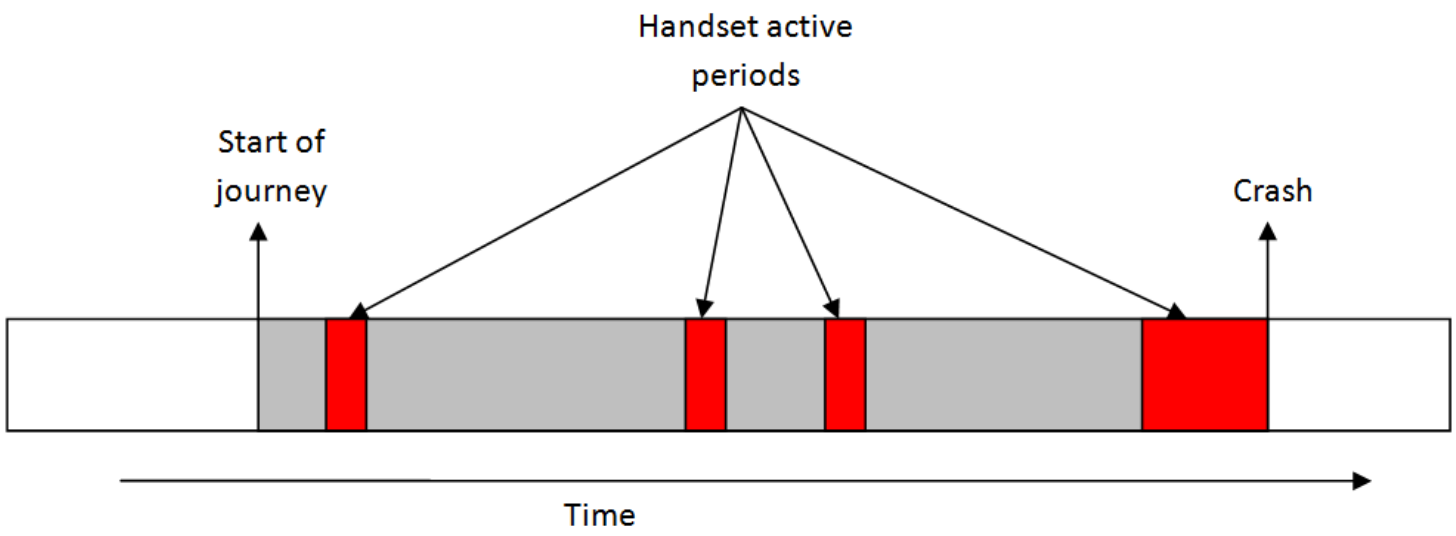
IPhone Analysis

- Pressing the power button:
  - [Display] active=yes; brightness = 50.0%;
  - [Display] active=yes; brightness = 0.0%;

- Unlocking the handset:
  - [Springboard-states] Screen_state=unblanked; lock_state=locked;
  - [Springboard-states] Screen_state=unblanked; lock_state=unlocked;

- In-car charging
  - [Battery] log entries indicate when the device is connected to a charging facility
    - Proceeding log entries show the continuous charge of the iPhone's battery.

iPhone Analysis



iPhone Analysis

- Identifying the usage of applications
- `[Application]`
- `Executable=` – Application in use
- Modes:
  - Foreground Running
  - Background
  - Running
  - Terminated
  - Suspended

iPhone Analysis

```
07/28/14 00:00:48.181 [Network Connections Symptoms] procName=com.apple.facebo; bundleName=<
07/28/14 00:00:48.190 [Network Connections Symptoms] procName=syncdefaultsd; bundleName=<unkr
20:55:26.239;
07/28/14 00:00:48.191 [Network Connections Symptoms] procName=itunescloudd; bundleName=<unkn
07/28/14 00:00:48.196 [Network Connections Symptoms] procName=Phantom; bundleName=7324EM48KV.
22:22:34.705;
07/28/14 00:00:48.203 [Network Connections Symptoms] procName=Preferences; bundleName=com.app
21:00:44.148;
07/28/14 00:00:48.205 [Network Connections Symptoms] procName=fakemsg; bundleName=com.fakems
21:47:34.414;
07/28/14 00:00:48.209 [Network Connections Symptoms] procName=libidtool; bundleName=<unknown>
07/28/14 00:00:48.211 [Network Connections Symptoms] procName=CommCenterClassi; bundleName=<
11:40:36.326;
07/28/14 00:00:48.215 [Network Connections Symptoms] procName=aosnotifyd; bundleName=<unknow
07/28/14 00:00:48.222 [Network Connections Symptoms] procName=mstreamd; bundleName=<unknown>
07/28/14 00:00:48.224 [Network Connections Symptoms] procName=ubd; bundleName=<unknown>; wif
07/28/14 00:00:47.704 [Application] id=de.andi.syslogman; pid=<unknown>; mode=Foreground Run
07/28/14 00:00:48.413 [Application] id=com.apple.mobilemail; pid=212; mode=Background Runnin
07/28/14 00:00:48.905 [Application] id=com.facebook.Facebook; pid=217; mode=Background Task
executable=Facebook; version=12.1;
07/28/14 00:00:48.995 [Application] id=com.apple.mobilecal; pid=227; mode=Background Task Su
07/28/14 00:00:51.294 [Display] active=yes; brightness=10.5%; user_brightness=<unknown>; als
07/28/14 00:00:51.311 [SpringBoard-states] screen_state=unblanked; lock_state=unlocked;
07/28/14 00:00:51.310 [Application] id=de.andi.syslogman; pid=347.00; mode=Foreground Runnin
07/28/14 00:00:52.165 [SpringBoard-screens] Screens=3;
07/28/14 00:01:06.559 [Battery] level=74.96%; voltage=3941 mV; current=-230 mA; current_capa
adapter_info=0; connected_status=0;
07/28/14 00:01:06.651 [Network Statistics] interface=en0; tcpNoConnNoList=23; tcpCleanup=8;
```

iPhone Analysis

- Hand's free kits
  - Not illegal – BUT, must be used!
  - Its presence in the car does not suggest that the device was paired with it.

- Testing with a 'Plantronics M20' hands-free kit when simulating call activity showed Telephony records indicating a call and audio had been routed to a 'headset

```
09/03/14 13:46:21.744 [Telephony]…
call_status=Active;
09/03/14 13:46:21.801 [Audio]
active=YES; route=HeadsetBT;
09/03/14 13:46:32.350
[Telephony]…call_status=Inactive
```

Android Analysis

Android Analysis

- No equivalent of the CPL could be located on the android handset.
- Focus was maintained on the Androids' buffer logs accessible under `/dev/log`.
- Volatile – when power is removed from the handset, content is gone.
- Access is provided by Android Debug Bridge (ADB).

Android Analysis

- Type and size considerations…

Table 1
Types of buffer log

Type	Main buffer log
System	System messages for debugging
Main	Main log buffer by default
Events	System events-related messages
Radio	Radio/telephony-related messages

Table 2
Default buffer log size variations by operating systems.

OS version	Log size
4.4 (Kit Kat)	All logs 256 kb
4.3 (Jelly Bean)	Main (2048 kb), system & events (256 kb), radio (1024 kb)
2.3 (Gingerbread)	All logs 64 kb; except events log (256 kb)

Android Analysis

- Buffer logs contain records of activity on the handset, similar to the CPL.
- Entries are prefixed with a Process ID (PID) which can be used to filter logs for activity.
- Using the `logcat` command buffer logs can be extracted for further analysis

```
Adblogcat -b events -v long >
output.txt
```

ADB

Android — adb — 80×24

```
668,52250009,430441,1426774637062]

[ 03-19 14:17:10.159   712: 1085 I/am_create_service ]
[0,1120755792,.WeatherIntentService,10253,3041]

[ 03-19 14:17:10.429   712:  712 I/notification_cancel ]
[com.htc.sense.mms,123,NULL,0,0,64]

[ 03-19 14:17:10.429   712: 1352 I/am_create_service ]
[0,1117277488,.ProductivityService,10078,933]

[ 03-19 14:17:10.429   712:  712 I/notification_cancel ]
[com.htc.sense.mms,123,NULL,0,0,64]

[ 03-19 14:17:10.499   712: 1085 I/am_destroy_service ]
[0,1117277488,933]

[ 03-19 14:17:10.769  1048:17102 I/content_query_sample ]
Binder:22814

[ 03-19 14:17:11.250   712:  924 I/am_destroy_service ]
[0,1120755792,3041]

_
```

Android Analysis

- Some examples:

PID entries and description.

PID	Description
screen_toggled(752):0	Handset sleeping.
screen_toggled(752):1	Handset active but locked.
screen_toggled(1065):2	Handset unlocked.
am_proc_start	Indicates application has been executed.
am_destroy_service	Indicates application has been closed.
Am_on_resume_called	Indicates application previously running in the background has been executed.

Android Analysis

- Is this approach practical in an accident investigation?
- ADB can access log information even if handset is locked – providing debugging mode is enabled.
- All that is required are drivers for the handset and the ADB application.
- Time is the issue….

Android Application

- The buffer logs are volatile and of a small size.
  - More activity on the handset increases overwritten data.
  - Handset must remain on until investigated therefore activity is constantly changing.

  - How long do you have?
    - Depends on make/model for size of buffer logs.
    - Activity on handset
    - Potential for about a 2-6 hour period where buffer log content denoting the activity on a device directly prior to an incident will still be present.

Device Integrity

- As the device must stay on for buffer logs to be acquired, the device will change and possibly received outside communications.
- Analyse at the scene.
  - Forensic laptop
- Analyse in the lab
  - Speed at which device can be transferred there.
  - Faraday technology.
    - Battery considerations.
    - More battery activity, potential for logs to be overwritten quicker.

Future work

- In-built engine management systems with hands-free/phone synching capabilities.

- Passive activity on different handsets
  - Windows phone
  - Blackberry

Any Questions?