

# Interaction Design Portfolio

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# The future of Interaction Design

## Human-Robot Interaction, application areas and the key issues that researchers are currently exploring

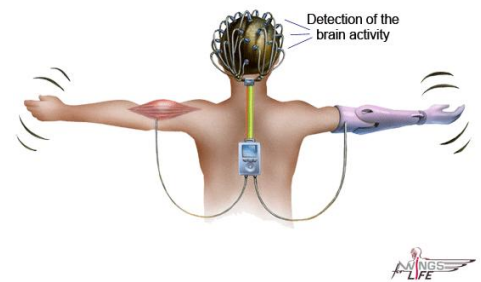
### Brain-Computer Interface (BCI)

BCI or Direct Neural Interface is a means of communicating directly with a machine using brain waves.

The two main applications for BCI technology that are being researched extensively are the possible applications of such devices to aid the lives of the people with a physical disability; for example by replacing limbs with robotic equivalents and the use of the technology for interacting with 3D virtual environments.

There are various kinds of BCI varying from invasive that involve implants in the grey matter of the brain to non-invasive types such as electroencephalography (EEG) where electrical activity is recorded externally via sensors placed on the scalp all with varying degrees of success.

The premise of the technology is to take readings of electrical signals in the brain and decipher those which are relevant to an action the device can emulate. For example, a person with an amputated leg trying to kick being translated into relational movement of a prosthetic one- or movement through depth of a virtual environment by various mappings to the movement of imaginary limbs. BCI research received its impetus from animal research reconstructing movement from microelectrode recorded spike trains or synaptic field potentials (Donoghue, 2002)<sup>1</sup> (Nicolelis, 2001)<sup>2</sup>. After extensive training and the implementation of learning algorithms (for an exception, where animals learned rapidly, see Serruya et al., 2002)<sup>3</sup>, monkeys move cursors on screens toward targets or an artificial hand moves in four directions directed by spike activity, demonstrating the possibility of translating cellular activity into simple movements online. After such training, even complex movement patterns can be reconstructed from an astonishingly small number of cells located in the motor or parietal areas (Musallam, Corneil, Greger, Scherberger & Andersen, 2004; Nicolelis, 2001; Schwartz et al., 2001; Taylor et al., 2002)<sup>4</sup>. (Birbaumer, 2006)<sup>5</sup>



BrainGate (BrainGate, 2010)<sup>6</sup> is an implant based system developed with the goal of improving the quality of life for the physically disabled. The areas they are exploring mostly surrounds prosthetics and the development of their technology to allow for the movement of bionic limbs or wheelchairs as well as the operation of computers i.e. moving a cursor with power of thought alone.

There are a variety of issues with the technology, firstly the main types are:

- Invasive – Implants placed within the grey matter of the brain.
- Partially-Invasive – Implants placed inside the skull but not within the brain.
- Non-Invasive – Readings taken externally from the body, e.g. via sensors on the skin.

Invasive BCIs are almost exclusively used in animals using implanted electrodes in brain tissue, and non-invasive BCIs using electrophysiological recordings in humans. Clinical applications were reserved with few exceptions for the non-invasive approach: communication with the completely paralyzed and locked-in syndrome with slow cortical potentials, sensorimotor rhythm and P300, and restoration of movement and cortical reorganisation in high spinal cord lesions and chronic stroke. It was demonstrated that non-invasive EEG-based BCIs allow brain-derived communication in paralyzed and locked-in patients but not in completely locked-in patients. At present no firm conclusion about the clinical utility of BCI for the control of voluntary movement can be made. Invasive multi-electrode BCIs in otherwise healthy animals allowed execution of reaching, grasping, and force variations based on

spike patterns and extracellular field potentials. The newly developed fMRI-BCIs and NIRS-BCIs, like EEG BCIs, offer promise for the learned regulation of emotional disorders and also disorders of young children. (Birbaumer, 2006)<sup>7</sup>

Obviously there are potentially many complications regarding these different types. Both invasive types live up to their title by requiring surgical alterations to the user before they can use the technology- and complications surrounding the surgery such as scar tissue forming around the implants which can cause them to emit weaker signals or become entirely lost as the body rejects them. Also, equally whilst not requiring the user to undergo an operation the non-invasive technology is proportionately less effective than its rivals due to the interference and scattering of electrical signals caused by the skull.

## Face & Gesture Recognition

Basic implementations of this technology have been available commercially for years now mostly as part of video gaming experiences such as Sony's EyeToy or more recently Microsoft Kinect as well as simpler solutions such as the face recognition features built into modern digital camera.

A simple example of this technology was recently posted on Engadget (Robot Curtain, 2010)<sup>8</sup> featuring a surveillance camera which a hardware hacker hooked up to a computer and motorised curtain rail, allowing via face recognition for the curtain to draw in front of passers-by. Not the most practical of solutions but a good example of some of the weaknesses that have to be thought of when working with the technology such as multiple people being in shot, different body movements and anticipating movement / adapting when people try to trick the system.



The technology works by the device using algorithms to match the image it's seeing against information it stores in a database regarding the structure of the eyes and nose, their respective distances and colour temperatures of skin tones (ShutterShocks, 2010)<sup>9</sup>. Once this data has been analysed the device in question can sanction an action relative to where it believes the user(s) to be, in the case of cameras this would be focusing the lens appropriately and for video games most commonly overlaying some kind of augmented reality.

The technology in place extends well beyond just face recognition however, newer implementations such as the Microsoft Kinect (Microsoft Kinect, 2010)<sup>10</sup> are able to distinguish full body movements allowing users to interact with virtual elements using their hands without the need for costly motion capture equipment. Equally there are many issues and limits to this technology; the main being the difficulties regarding perception of depth which in no way can match the quality of three-dimensional movement available via motion capture studios- and that in setups designed for interaction by multiple users, there are a variety of complications that arise when considering obstruction of view.



ASIMO (Advanced Step in Innovative MObility) is a robot famously developed by the Honda Corporation. ASIMO is very aware of its surroundings and makes use particularly of both face and posture / gesture recognition. ASIMO relies on facial mapping, recording the topographical features of a person's face and electronically storing the data in its internal memory. When ASIMO sees a face, it compares what it sees with the data in its memory to try to identify a match. If a match is found, ASIMO will respond with a unique greeting for that person even when ASIMO or the human being is moving. For example, ASIMO can recognize the faces of people which have been pre-registered, addressing them

by name, communicating messages to them, and guiding them (ASIMO - Honda, 2010)<sup>11</sup>. ASIMO is a good example of where all these technologies begin to merge to form a singular entity capable of being aware of its surroundings and interacting with humans; Honda have also been conducting research into controlling ASIMO via brain waves linking back to the aforementioned BCI technology (Mind over matter, 2009)<sup>12</sup>.

## Interaction design issues when designing collaborative applications for the Microsoft Surface

One of the biggest issues with the Microsoft Surface outlined at the BRL was that because it uses infrared light to detect objects and fingertips on the surface it can therefore not be used outdoors or near windows where natural light can cause interference. This no doubt is a serious concern when taking into account the target markets for the device which are hospitality businesses, such as restaurants, hotels, retail, public entertainment venues and the military for tactical overviews (Microsoft Surface, 2010)<sup>13</sup>; all places where exposure to natural light is a more than likely occurrence. Microsoft does recommend a selection of third-party screen filters (Microsoft Surface: Lighting Considerations, 2010)<sup>14</sup> to aid the interception of such interference but this requires changing the environment around the device and at additional expense to the customer.

The Scotland Yard game presented on the Microsoft Surface at the BRL illustrated a variety of interaction design issues regarding collaborative applications using the technology. As per Jacob Nielsen's usability heuristics (Molick & Nielsen, 1990)<sup>15</sup>, familiarity is an important consideration; especially when it comes to touchscreen devices. A classic example of a successful interface would be the interaction between Google Maps on mobile devices- with a pinching and grabbing motion to allow for zoom and movement. Whilst this works well in matching real-world actions to an interface, I feel that the Scotland Yard game does not. There are two key barriers to the interaction; there is an inherent complexity of the game which is then further compounded by the multi-touch interactivity, creating an experience the user would find difficult to relate to.

When designing collaborative applications on a large device such as the Microsoft Surface it is important for interaction designers to take into consideration the cognitive load of the user. There are a wide variety of examples in other fields such as web design, where information is structured poorly and difficult to interpret. Similar concepts such as the use of white space will still apply when up scaled to the large screen boasted by the Microsoft Surface, and thus these considerations should still be taken into account when designing interfaces in order to prevent information overload.

Alike any interface design, gestalt principles play an important role- a good example of how they could be used on an interface such as the Microsoft surface would be by separating information on the screen into tangible objects that could then be manipulated via touch but due to similarity are still representative of a collection of related things. Other issues to be considered when building applications for the Microsoft Surface could be the consideration of ensuring that the technology is being used to aid an interaction rather than define it; such as by only using the features such as object recognition when it actually enhances the experience rather than because it is available.

An issue of particular concern when building collaborative applications is regarding how the Microsoft Surface would be able to distinguish between multiple people using device within close proximity to each other. In the gaming retrospective this could involve two people interacting to achieve the same goal and ending up inputting gestures that the technology interprets differently to what was envisaged by the users- causing confusion and for their efforts to possibly prove annoying as one users interactions counter or interrupt another's.



## Problems regarding speech-based interaction for a companion robot like Kompai

There are clearly a variety of issues regarding the speech-based interaction with robots such as Kompai. One of the main ones demonstrated in the presentation being interference from a noisy surrounding environment which increases the difficulty the robot has interpreting any commands it is being sent by the operator.

This would also extend to issues with speech that is not aimed towards the robot, for example a television, radio or simply humans talking to each other. Whilst these could have a preliminary solution of requiring commands in a certain format such as prefixing the instruction with the name of the robot, this still leaves wide scope for

mishearing other words and interpreting them as the prefix and either way significantly extends the length of time the entire interaction takes.

Other issues that would be likely to arise are those involving dialects and internationalisation. It was alluded to that Kompai like other systems I have seen requires voice calibration prior to use- whilst this is common it is still less than ideal and means that other users cannot interact with the device without re-calibrating it. There are also additional complications especially with Kompai's use-case scenario in that the variety of tasks it can perform will be individually mapped to key phrases which may not span all dialects as the logical way to describe that task- and with the system being designed for the elderly their capability to memorise new instructions or understand the need to initiate tasks with a certain phrase rather than a variation of the words such as:

*“Could you make me a cup of tea Kompai?” and “Would you mind bringing me a cup of tea Kompai?”*

These kinds of variations would either need accounting for in the speech-task recognition or for the user to be trained as to what format to provide commands in, the latter of which could prove the robot difficult to interact with.

### Problems with humans and robots performing co-operative tasks in a co-located space



Obviously, the largest consideration for humans and robots performing co-operative tasks in a co-located space is the issue of safety. The most simplified example of this would be on production lines, such as those for car assembly; the large robotic arms that comprise the machine and allow for the lifting of large heavy metal parts make it imperative for there to be whole areas sectioned off from human access (such as the yellow caging in the photo) whilst the machinery is in operation in order to avoid inevitable collisions.

Regarding robots such as Kompai, which have direct interaction in close vicinity to people it is imperative that the robot is fully aware of its surroundings. As demonstrated, Kompai tackles this problem by doing a comprehensive scan of the surrounding area using sonar technology. But, this too has its limits- considering that areas can change significantly and rapidly.

Another issue that was highlighted during the demonstration was that of Kompai trying to locate itself within the map it had created of the area around it. I attended a lunchtime talk recently at the Pervasive Media Studio (Indoor Positioning, 2010)<sup>16</sup> regarding the topic of ‘indoor positioning’ which covered a variety of technologies that people have attempted to adapt to this use scenario with varying degrees of success. Examples ranging from GPS which at best can give accuracy within ten metres, and only when given a clear view of the sky to more feasible solutions such as WiFi packet sniffing which by assessing the signal strengths and known locations of multiple WiFi access points surrounding a device can be used to estimate a location within that area.

An important factor of human-robot interaction within co-located space is that of gesture recognition and interpretation of other visual information. When two humans interact there is a variety of non-verbal information exchanged which goes unnoticed; but never-the-less is essential to maintaining a successful transaction. For example, when simply passing an object from one person to another, both participants will be aware of the gaze of the other and the sender will receive physical feedback when passing the object in order to interpret that the intended recipient has a firm grip of the object so that they know when to release it entirely in order to avoid it being dropped. Whilst these are simple enough variants that one takes as a given for human to human transactions, it is something that needs compensating for in robots to allow for successful interactions with humans. After-all, the suggested use-case for Kompai is to aid the elderly and physically disabled; and one of the primary means of care would be to bring things to the human recipient.

Another issue is whether technology can be trusted when taking over integral parts of our life. Going back to BCI, back in May of this year (2010) a German company announced that they have reached the stage where their development of thought controlled prosthetic arms were ready to hit the market, having extensively tested the device on Christian Kandlbauer who has an amputated arm (Briggs, 2010)<sup>17</sup>. The mind controlled-prosthetic limb was such a success that he was the first person in the world using this technology to drive a car. Sadly, in October, Christian died in a car crash in Austria (BBC News, 2010)<sup>18</sup>. Whilst it is still unknown as to whether his bionic arm played any role in the accident- it further emphasises the point that this technology, whilst it has the capability to significantly improve our lives; it is important to assess and establish that the technology is reliable enough to take over roles traditionally given to humans.



## Review

My main learning outcomes from this research are regarding the significant progress that has been made in these technologies. When I last looked into BCI, the technology had matured to a stage where participants in studies could move a dot around a screen via non-invasive sensors attached to their head. There was much promise of the possible future applications of this technology to improve lives and it is good to see that progress has been made here.

Visiting the Bristol Robotics Lab and learning about how the various projects aid collaborative user interaction with devices has opened my eyes to the world of extendable use of technology outside of personal computers and mobile devices, all aimed primarily at a single user making use of them at once, and the possibilities surround that.

I have also learnt a lot the various problems encountered and issues that have to be considered when developing applications and building machinery that operate in a human co-located space. Including, ensuring the safety of the humans involved and allowing for interactions which both parties can understand and interpret feedback from.

# Requirements Gathering and Analysis

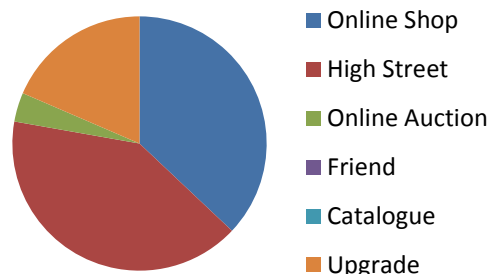
## User Questionnaire

For my first piece of research I conducted an online questionnaire (see Appendix: Questionnaire) which I publicised via Facebook and Twitter, which received data from 27 individuals.

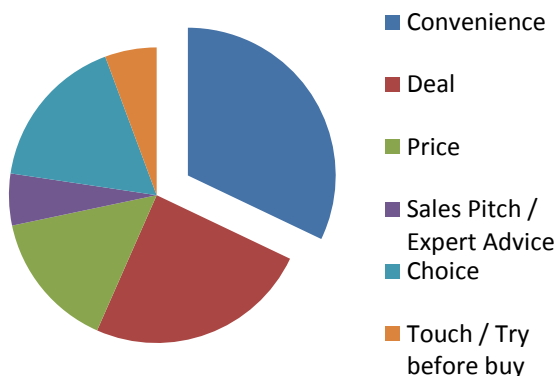
### Purchasing Method

As I had expected a significant proportion of the individuals surveyed purchased their current handset via an online retailer. Surprisingly however, there were just as many people who purchased from the high street.

None of the individuals studied obtained their current device via a catalogue or a friend, whilst some did get theirs via an upgrade given by their network provider.



### Reasons for chosen method

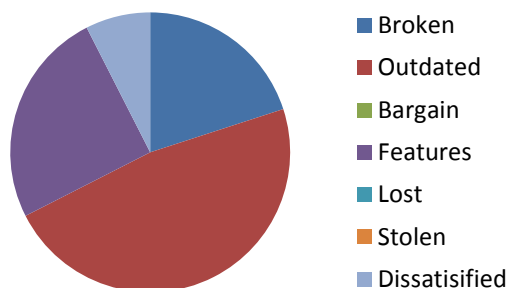


Convenience was a clear motivator for people who shopped via the high street and online stores, as was deals which also showed to be particularly popular amongst those who opted for an upgrade.

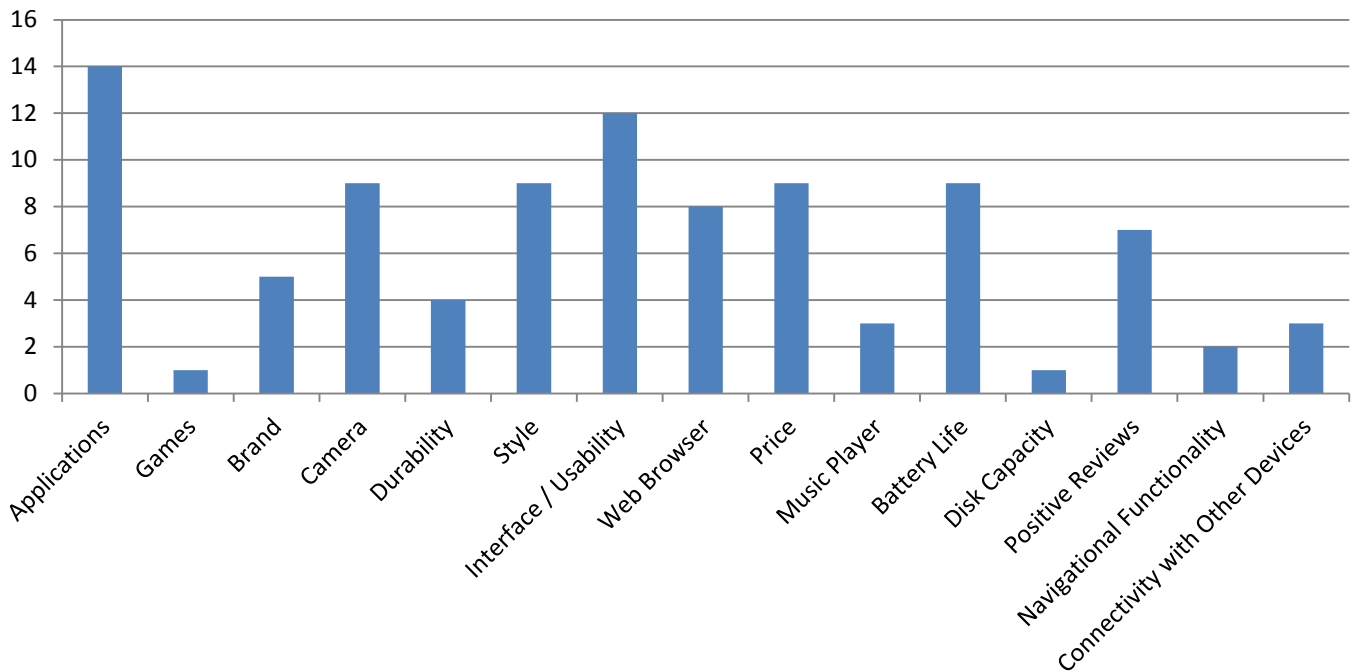
Very few questioned felt that they had been influence by any form of sales pitch or desire to be able to see or touch the device prior to purchase.

### Reasons for Upgrading

A vast proportion of the people surveyed said that they bought a new phone to replace a previous out-dated one, followed by the desire for new features or the fact the previous handset broke. All of these motivators seemingly relate to the failings of a previous handset creating the need for a replacement.

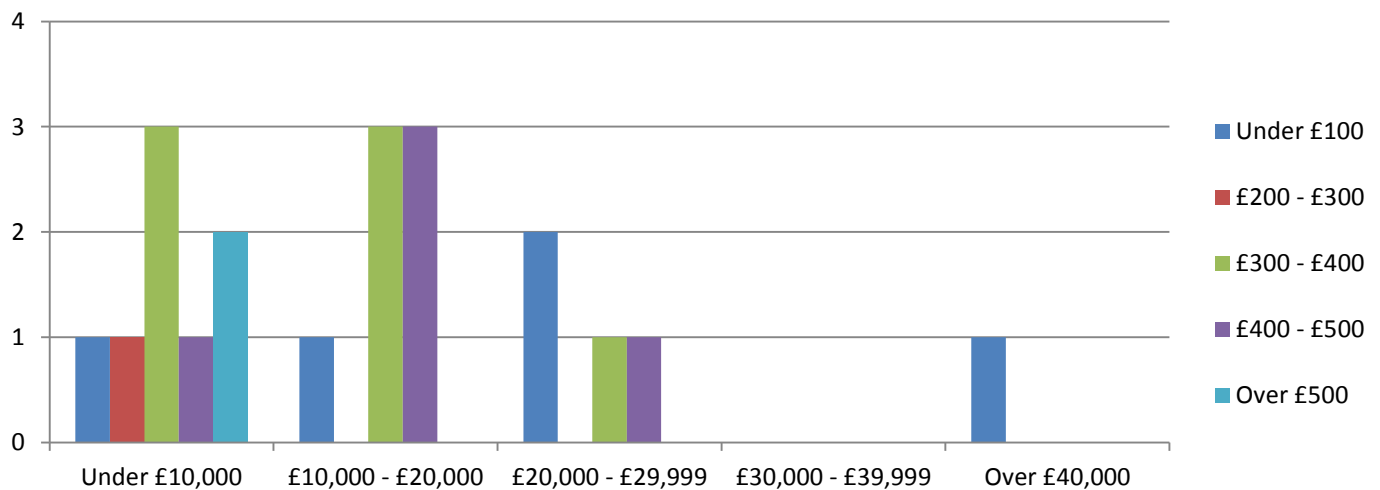


## Features



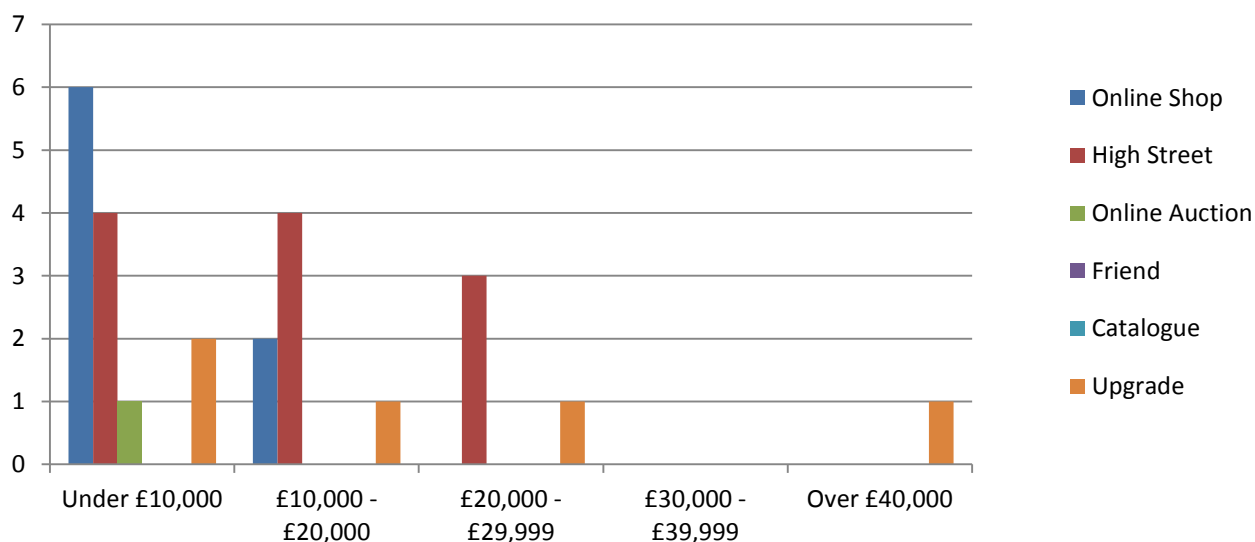
I asked users to select the top three features they looked for when choosing a new mobile phone. A high quality user interface and the ability to install applications stood out as prominent aspects that consumers look for. Interestingly, games scored low with only one person saying that this was feature they would be looking for. When comparing this with statistics produced by Apple regarding their iPhone as a gaming platform, it would suggest that games are a commodity that whilst proves popular does not drive purchasing decisions.

## Average Annual Income Compared to Price



As part of my survey I asked people to give a rough indication of their annual income so that I could see if there was any correlation between that and their consumer behaviour. Whilst the sample I took is nowhere near adequate enough to make a full judgement, there was still patterns beginning to emerge. Logically, I would have expected for people on a higher income to be more willing to spend more on a mobile phone. However, my results seem to indicate that this is not true and in fact the opposite; with people in the lower two bands often spending between £300-500 and spending of under £100 being more popular in the higher wage brackets.

## Average Annual Income Compared to Purchasing Method

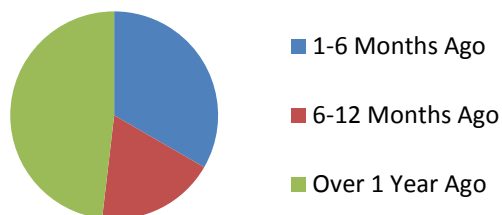


Online shopping was clearly far more popular in the lower wage bracket; obviously this would more than likely be linked with the quantity of students filling out my survey and their use of I.T. over older generations. Also possibly biased based on the number of web design students filling out my questionnaire. However, it is still clear from these results that the high street choice spreads a wider range of incomes.

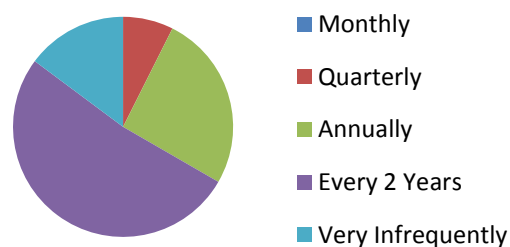
## Frequency of Purchase

These results give a clear indication as to the longevity of these devices, with most people replacing their mobile phone only every two years or more. However, it is also shown that over half of the people surveyed have purchased a new handset within the last year, which is more than likely due to the recent releases of the new Android devices, Windows 7 phones and the iPhone 4- which could possibly have swayed people to upgrade earlier than as per their normal pattern.

### When did you purchase your current phone?



### How often do you buy a new phone?



## Ethnographic Study

For my second piece of research I chose to go to high-street mobile phone retailers and assess the criteria staff in-store use to assess potential customers and guide them to choosing a handset. In order to collect more useful data I acted as if I know very little about mobile phones, and was looking for a new handset for Christmas. To aid this I also took along my housemates old Nokia 6021, concealing my own iPhone 3GS, which would leave only a small selection of devices as a logical upgrade.

### Phones4U (Broadmead near Cabot Circus)

The store was laid out into two main sections, the walk-in handset display area, with staff roaming around with the clear objective to usher you in. Behind that there were seated areas with an individual computer screen for one-on-one chats with sales staff.

- Having entered the store I was approached within 10-15 seconds and asked if I needed any help.
- I responded with “I’m looking for a new handset, but I have no idea what I want.”
- Having been asked what phone I have currently, I produced the legacy phone- which the staff member mused at- referring to it (somewhat rightly) as archaic.
- I was asked if I wanted to come have a chat with another member of staff to discuss my options such as whether I would like a touchscreen phone or other particular features.
- Having been sat down and introduced I was asked for my name (to which I only gave my first) and phone number- I was also asked what network I am currently on; which I responded with O2.
- I was then asked what price range per month I am looking for, clearly it was assumed I would not want pay-as-you-go; that or they just did not want to sell me it- I responded with ~£30.
- Next, I was asked whether staying on the same network was imperative and also if it was important that I keep my existing number, to which I replied no and yes.
- I was then asked whether I would like a touchscreen device, to which I replied yes- and was then told about some handsets, with the Samsung Galaxy on an Orange tariff being one that was somewhat pushed as a cheaper option. Aside from specifying a loose price constraint I had not really implied that price was a particular issue- I can only assume that this may have been interpreted by my age and appearance.
- From here I was given a sales pitch featuring four or five handsets / capacity options on two or three tariff choices. She covered total minutes, SMS messages, internet limits and monthly payments and initial one-off prices for handsets. Assessing that that was quite a lot of information she proceeded to sketch out a quick table outlining some of the top handsets and the various options available (see Appendix: Phones4U Information - Phone, Network & Tariff Summary).
- The conversation was drawing to a close having given me a good amount of information to go off and make a choice regarding what phone I wanted, I was encouraged to come back and ask for her- and quickly talked through and given a leaflet about the benefits of their mobile phone insurance options (see Appendix: Phones4U Information - Insurance Leaflet Extract).

### Carphone Warehouse

I attempted to replicate a similar piece of research at the two Carphone Warehouse stores in Broadmead. In fact collectively I went into the two stores about five times in total. However, they seemed to have far less staff and do not really jump on you when you are browsing the handsets- I got fed up of waiting after a few minutes each time

and left, I would imagine they could potentially lose a lot of custom like this; I would have gone and asked to be spoken to however the few staff that were around tended to look busy or were talking to other customers.

Regardless I still got an impression from their stores; the larger of the two boasted a similar layout to Phones4U, with a large handset area and a sit-down chat area in the back- with about ten tables. I imagine had the staff been on the ball that day that the experience would not have been too indifferent. The smaller store in fact had more staff but a smaller store area, meaning no room for a one-to-one chat area; again I didn't get to speak to anyone but my general impression was that the whole process was far more relaxed- presumably not to intimidate or put pressure on potential customers.

### Tesco Phone Shop

Walking further along Broadmead I was handed a leaflet advertising Christmas mobile phone deals by a man stood outside the newly opened Tesco Phone Shop (see Appendix: Tesco Phone Shop Christmas Deals), I proceeded inside. The store was again quite small (and cramped), with quite a few staff and customers taking up most of the space. There was no one-on-one area; simply a couple of touchscreen computers on the wall where presumably sales occur.

- Similarly as previously encountered, I was asked if I needed any help- I replied with my generic clueless response.
- The sales assistant explained their basic layout of pay-as-you-go phones on one side and monthly tariff devise on the other.
- Having presented my legacy phone on request I was asked if I liked the number pad and whether I would want a new phone with one, or a full QWERTY keyboard, or a touchscreen. I responded with touchscreen.
- I was then shown a few phones and asked what key features I would be looking for, I responded with calling and texts.
- She then pressed further regarding whether I would be interested in apps and or internet access. To which I replied yes to both, but remaining vague on the topic.
- The app stores on the various devices were then explained to me and some of the applications available.
- I was then taken to a stand of Blackberries and further quizzed on whether I would want to use Facebook on the move to which I responded that I use emails- which led them to the conviction that a Blackberry would be the right choice.
- I was then taken to look at the Blackberry Curve? Which I believe to be their top handset at present and given a small demo of some of the handset's basic functionality.
  - The demo included basic quick input features the phone boasts for aiding my emailing needs, which included the full slide-away QWERTY keyboard or on-screen touch keyboard 'swipe interactions' for quick input.
  - She also spoke briefly about BBMS, Blackberries inbuilt free messaging service between Blackberry users, which is popular with students.
- The sales assistant then proceeded to push the Tesco tariff, and also other various contractual options and how they would be cheaper for internet usage- to which I responded gratefully having stuff to consider now and left.

## Phones4U (Broadmead near the mall)

Having already conducted research at a Phones4U store I then came across another further down the road, so figured I would repeat the research for comparison.

- Slightly slower response, but I was still approached in under a minute despite the store being quite busy.
- Again, I was asked what handset I have- and having produced a legacy Nokia device the sales assistant jumped on the brand and started pushing newer Nokia devices at me, disregarding that I expressed no particular interest in sticking with the brand, nor having any conviction either way- and additionally being stood looking at Android devices.
- Having pointed at a poster and saying do you want that? I shrugged and asked what it did; I was then ushered to sit down whilst he quickly fetched an actual handset.
- On return he proceeded to go through every main feature of the phone including the keypad and messaging interfaces, of which he insisted I try pressing button via the touchscreen.
- He seemed quite keen to push the HDMI interface for connecting the device to a TV for streaming films.
- I was then walked through:
  - Video (Upcoming Movie Trailer: Tron Legacy)
  - Random application icons on the 'desktop' area.
  - Music
  - Camera (asked me to take a photo of him to demonstrate the clarity)
  - Various other interfaces, sales assistant didn't seem to know how the phone worked all that well.
- Having not been asked many questions at all I pushed for information asking how the device compared to competitors such as the iPhone, I was simply given the response "it costs more, because it's better".
- After this, I had assessed that I was going to struggle to get much more useful information out of this particular sales assistant, he had finished the schpeal and seemed to be waiting for me to agree a sale, despite having been talking for under two minutes.
- I alluded (once more) that this was research for a Christmas present and that he had given me plenty to think about and politely thanked him for his time, to which he blurted out that he would give me £50 for my old handset right now. I respectfully declined and left.

## Summary

My questionnaire yielded some good results; it is however important to acknowledge there is the significant possibility of bias based on the demographic studied. I publicised the questionnaire via Facebook and Twitter, where the majority of people who would have seen and contributed to the study would have been students around my age and on a fairly low wage bracket. Also, whilst 27 responses are fairly good within the scope of this assignment, one would want a larger selection in order to come to more reliable conclusions from the results if making design decisions for use in industry. To improve the accuracy of the results I would have taken the questionnaire to the high street in order to get a larger number of completions from a wider demographic.

Again, further iterations of the same research process would also have been beneficial for the ethnographic study I completed- given time it would have been useful to try out the technique in other stores, perhaps in different cities in order to get a fuller impression of the sales tactics used by the staff on the high street.

It was clearly from my ethnographic study that device interaction is an important part of the decision made by consumers, amongst the first questions from all the stores I visited were whether I would like a touchscreen phone or not- something I had not concluded from my questionnaire. I also noted that people are very interested in applications available as purchasing criteria; this was shown initially by my questionnaire with it being top amongst the features deemed necessary by users, and furthered by the high street study. User-interface also ranked high in both my studies, with it being an important feature that consumers look for according my questionnaire, as well as personal interaction preference e.g. buttons/touchscreen being one of the first things sales staff ask you about in store.

Another thing I noticed during my ethnographic study was that various stores seemed to be pushing a particular device, leading me to thinking that perhaps they have specific devices that the staff are told to try and sell more of on a weekly basis. This was shown in the first Phones4U store I went to where the Samsung Galaxy seemed to be encouraged, and in the second one where the sales assistant seemed overly keen to sell me a particular Nokia device. This could be something that can directly relate to design criteria Phones4U already employ on their website, where certain devices are displayed on the homepage as the 'hottest mobile phones at the coolest prices'. Another interesting similarity to their web effort is how insurance was pushed at me at the very end of the conversation, much alike how it appears in your shopping basket towards the end of the checkout process as exhibited by CXPartners.

## Persona

### Jason

- 28 years old
- Works in financial services in central Bristol
- Single
- Has recently moved back to Bristol, he went to university here and really likes it
- Lives in a shared house
- Reads poetry online
- Goes out with friends Thursday - Sunday
- On a Vodaphone mobile contract
- Bought his current phone over a year ago and considers it very out-dated
- Constantly on the go during the day, eats breakfast and lunch at his desk
- He climbs indoors once a week
- Has no time to be waiting for stuff to load or patience for unintuitive interfaces
- Uses his current phone solely for business, but is intrigued by new technology
- He likes to be careful with his finances as he is saving to buy his own home



### Jason's goals for his new mobile phone

- He wants to find new places for evening meals
- Wants to be able to get up-to-date stock information
- Read the news

### Jason's questions about mobile phones

- What are the pricing options?
- Can I stay on the same network and keep my current number?
- If not can the number be transferred?
- What is the best phone for writing lots of emails on?
- Can I listen to music on the device?
- Are there any special offers available?

## Heidi

- 51 years old
- PA for central Bristol company
- Is recently widowed
- Reasonably well off, her house is paid for
- Her kids are grown up and have left home - they have exciting jobs in London
- Recently became a grandmother
- Likes hearing about the trendy new stuff her kids tell her about
- She loves to try new things and meet new people
- Has a great group of friends who meet up regularly
- Her job and boss are quite demanding
- Needs a new phone because her current one is broken



### Heidi's goals for her mobile phone

- Wants to be able to keep in touch with her kids easily
- Doesn't want to have to remember to charge the phone all the time
- Doesn't want to be carrying something huge and clunky around

### Heidi's questions about mobile phones

- Does it come with enough minutes so I can spend a lot of time chatting to my daughter?
- Can it take and receive photos of my grandson?
- Do any of them come with physical buttons still? I can't be doing with this touch-screen nonsense.

## Scenarios

### Heidi wants to look at phones with a good camera.

1. She enters the website via the homepage.
2. Selects 'products'.
3. Ticks the results filter labelled 'camera'.

### Jason wants to find out which phones come with a physical QWERTY keyboard.

1. He enters the website via the homepage.
2. Selects 'products'.
3. Ticks the results filter labelled 'keyboard'.

### Heidi wants to find out which non-touchscreen devices support photos and has a long battery life.

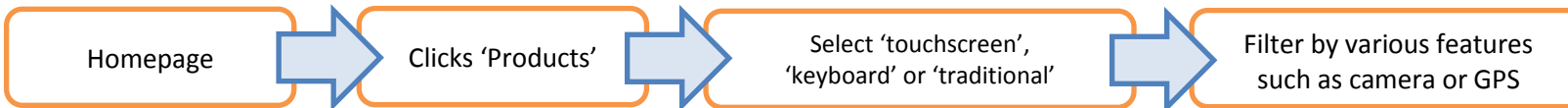
1. She enters the website from a bookmark.
2. Selects the 'products'.
3. Selects all devices other than touch-screen, including candy bar and slide.
4. Ticks the 'take photos' and 'extended battery life' on the 'it should be best for' filter set.

### Jason wants to compare several phones he has looked at.

1. He enters the website via a bookmark.
2. He adds several phones from a results set he is viewing to the 'comparison panel'.
3. He selects 'compare now' and receives a side-by-side technical specification of the devices he selected.

## Task Flows

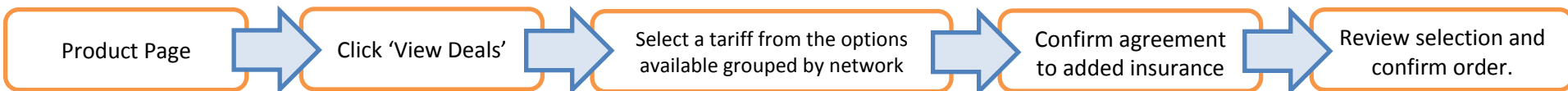
### Finding desirable products by filtering results



### Finding products based on network



### Placing an order



## Requirements

### Functional

1. Allow users to filter product results by interface means i.e. touch screen, number pad or keyboard.
2. Allow users to filter product results by features available on the device.
3. Allow users to compare multiple mobile phones in terms of features and functionality.
4. Push newly released or featured phones on the homepage.
5. Allow users to define whether they are looking for pay as you go or contract phones.
6. Allow users to define what network they are on, should they not want to change.
7. Filter results by price range.
8. Provide advice regarding best networks and tariffs.
9. Break down networks and tariff advice by the variations of the handset, such as capacity.
10. Save for later feature for users intending to come back to the website later.
11. Offer mobile phone insurance options at the end of the checkout process.
12. Provide a feature list for the phone.
13. Provide a technical specification of the phone.

### Non-Functional

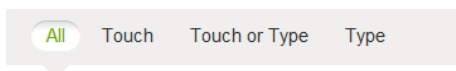
1. Facilitate the process of users find a new mobile phone that meets their specific needs.
2. Promote the current mobile phone(s) that the company aim to push.
3. Use positive user reviews to promote phones.
4. Promote applications available for devices.
5. Demonstrate mobile phone features.
6. Promote stylish, usable interfaces available on mobiles phones.
7. Allow users to compare mobile phones, key variations and tariffs.
8. Promote insurance cover.

# Website Analysis

## HTC

<http://www.htc.com/uk/product.aspx>

HTC have chosen to push their products based on the main feature that the device does best, such as music or gaming as per the example below. This is represented on their website in the form of sketches surround photos of the actual product available all around the website and as the focused content on the homepage.



HTC HD7



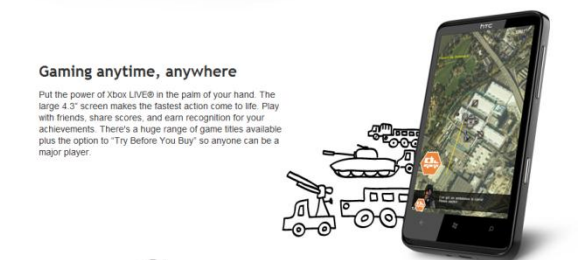
HTC 7 Mozart

Similarly to how my ethnographic study showed the method of interaction as being an important question early on in discussion in-store, HTC have also identified this and provided a solution. They have solved this by offering it as the only option for filtering your results from the main products page, in an effort to reduce clutter and provide the customer with a simple choice and ease their efforts to get to the product page they want.

HTC have made it very easy for users to decide quickly whether the phone they are looking at boasts the primary features they want or not. Main product pages start on the 'overview' tab, which features three large images with a bit of text, describing the three key features the handset has that make it stand out from the rest.

This is especially so with the visual aid sketches provided, which allow the user to quickly analyse whether the phone is best for music, gaming, or web browsing etc. and then make a decision whether or not to move on to the 'do more' tab which delves into other important features available on the phone.

Also covered is the need for further in-depth technical specifications which HTC have provided in a third tab, broken down into at a glance information giving phone metrics: weight, dimensions, screen size; and then to details regarding the physical technology in place grouped by topic with icons related to the content.



**What everyone's saying about the HTC Desire HD...**

“...the real news is the Desire HD, which has a glorious expanse of 4.3in touchscreen loaded into a classy aluminium body.”  
- Staff, Stuff.tv

“when it comes to internet browsing [HTC are] once again into familiar territory for the HTC Desire HD – just great.”  
- Gareth Beavis, TechRadar

“Here in the office we've been struck down with a serious case of Desire fever. In fact, we're as excited about the upcoming HTC Desire HD as it's possible to be without cracking a smile (we don't crack our sang froid for nobody).”  
- Luke Westaway, CNET UK

“We've just grabbed some hands-on time with HTC's new Desire HD, the company's new 4.3-inch flagship, and we're very impressed... the fast-boot is very impressive: in under 10 seconds the Desire HD went from powered off to running and ready to make calls.”  
- Chris Davies, Slashgear

[MORE QUOTES](#)

HTC also choose a selection of positive reviews to display on the main overview of product pages for items they have had on sale for some time, meeting the requirement identified and providing the user with points of reference from fellow consumers.



### Keep a cinema in your pocket

With its vivid 4.3" screen and Dolby Mobile and SRS audio, HTC Desire HD makes every day epic. Watch a Hollywood blockbuster on the bus. Premiere your home videos in your lunch break. Because with HTC Desire HD, wherever you are, you're at the movies.



YouTube™ player

With the world's favourite video site available at the touch of a button, you'll never be short of something to watch.



Ted Talks®

Something to stimulate your mind as well as your eyes. Watch the world's top thinkers talk about everything from synthetic life to viral music videos.\*

The user questionnaire I conducted identified that when purchasing mobile phones people are very much concerned about the applications available for the device.

For phones that support them HTC list a variety of activities as per other 'do more' page, but also suggest applications that the user could use to do them- applications that could eventually be part of their daily routine should they make the purchase.



### Mozart or Motorhead?

We all have different tastes in music. Let HTC Desire HD help you get the most out of yours. Make playlists on the go, set your favourite song as your ringtone, expand your collection with great music apps, then listen to it all in mind-blowing Dolby Mobile and SRS audio.



Shazam®

Want to know what that cool song is? Just start your Shazam app, hold your phone up to the song and it'll tell you in seconds. It really is just like magic.\*



Spotify®

The Spotify app puts millions of tunes in the palm of your hand. It's a lot easier than carrying around the CDs.\*

## Sony

<http://www.sonyericsson.com/cws/products/mobilephones>

Sony's design is a good reflection on the requirements I identified via my research. The design they had when I initially began this analysis allowed users to select the key features they need, the phone style via some contextual icons and actions the phone 'should be best for'. By choosing aspects like playing music or games the website automatically renders a selection of phones below that match the requirements specified.

**What do you want most?** Reset

3G Games GPS Wi-Fi Email

Media player Blogging Radio Internet

Video Sync Xperia GreenHeart

Facebook

**Choose your style** Reset

No preference

**It should be best for** Reset

Take photos

Make movies

Play music

Listen to FM radio

Access email on the move

Surf the Net fast

Stay organised

Style my handset

Connect to company network

Messaging

Playing games

Social networking

This also appears to be something that they have pushed forward to their new design which has emerged as of mid-December 2010, similar selections available are still available, with additional simplification of the 'features' section and addition of size as a filtering criteria.

Product family • **Style** Size Platform • Features

Viewing all 56 phones. Filter

- Stick/Candybar
- Clamshell/Flip
- Slider
- Touchscreen
- QWERTY keyboard

**Size** Platform • Features

- Any size  
Large or small
- Small phone  
Pocket-friendly
- Large screen  
Ultimate viewing

**Platform** • Features

- Android™
- Sony Ericsson
- Symbian™
- Windows Mobile®

**Features**

- Camera (8MP or more)
- Xenon flash
- HD video recording
- TrackID™ music recognition
- Walkman™ player
- Facebook™ application
- Dedicated gaming keys
- PlayStation™ remote play
- FM Radio

These options allow for users to narrow down their selection by as much or as little as they desire, and provide a useful tool for allocating a mobile phone best suited for their needs. The style and size menus in particular allow for removal of a significant number of devices the user would not be interested in, and this selection is made especially easy with the use of graphical icons to aid the descriptive text.



The demonstration criteria I identified have also been met by fairly complex flash animations depicting the various features of the device on product pages.

They do this not only by stating what is available, but also by rotating a three dimensional representation of the phone and highlighting desirable features whilst showing the interfaces the user would be interacting with, and the kinds of feedback they would

be able to expect to receive from the device. In addition to this, being given such an in depth visual tour of device could also be consider an attempt to replicate as close as possible via the medium in use the experience given in store of being able to touch and inspect the device close-up.



Whilst Sony do promote their features via a specifications page, they do not go into too much technical detail, leaving information out that would prove useful to certain users, I feel this is an area in which they could improve. There are also issues added by their various trademarked combined feature sets such as 'Mediascape™' and 'Timescape™', which batch various features up into somewhat ambiguous packages which I feel would more than likely confuse the user more than a simple (perhaps graphically enhanced) list of what the phone can do.

## Review

I have gained a wide selection of insights into the user research process whilst investigating consumer mobile phone purchasing behaviour, including how to better the process in future and areas where one would want to investigate in order to yield a higher quality of results.

My questionnaire was significantly biased by the demographic questioned (mostly students), in an industrial execution of the same research I would ensure that a far larger sample was taken across a wider spread of demographics representative of the target audience in order to be able to come to more profound conclusions from the results. Also, prior to any of this research, it would also be logical to assess the target audience of the website, thus allowing the research to be better targeted at particular demographics.

The ethnographic study that I completed I feel was a good method of gaining insight into the process that a consumer would have to go through on the high street. Again, given more time I could have gained further insights by going to more stores across a greater region. Also, I feel that there would be significant amounts of data to be collected by using different people, or actors portraying users with different needs in order to assess how the staff would aim to meet their individual needs via their questions, and what conclusions would be drawn. Similar research that I think would also yield into similar outcomes would be using 'fly on the wall' techniques on real consumers or by interviewing the staff in order to assess how they aim to aid customers and what criteria they use to match them to devices. I chose not to use these methods primarily to meet time constraints I had set but also to try and get more honest or real information on which to base my research.

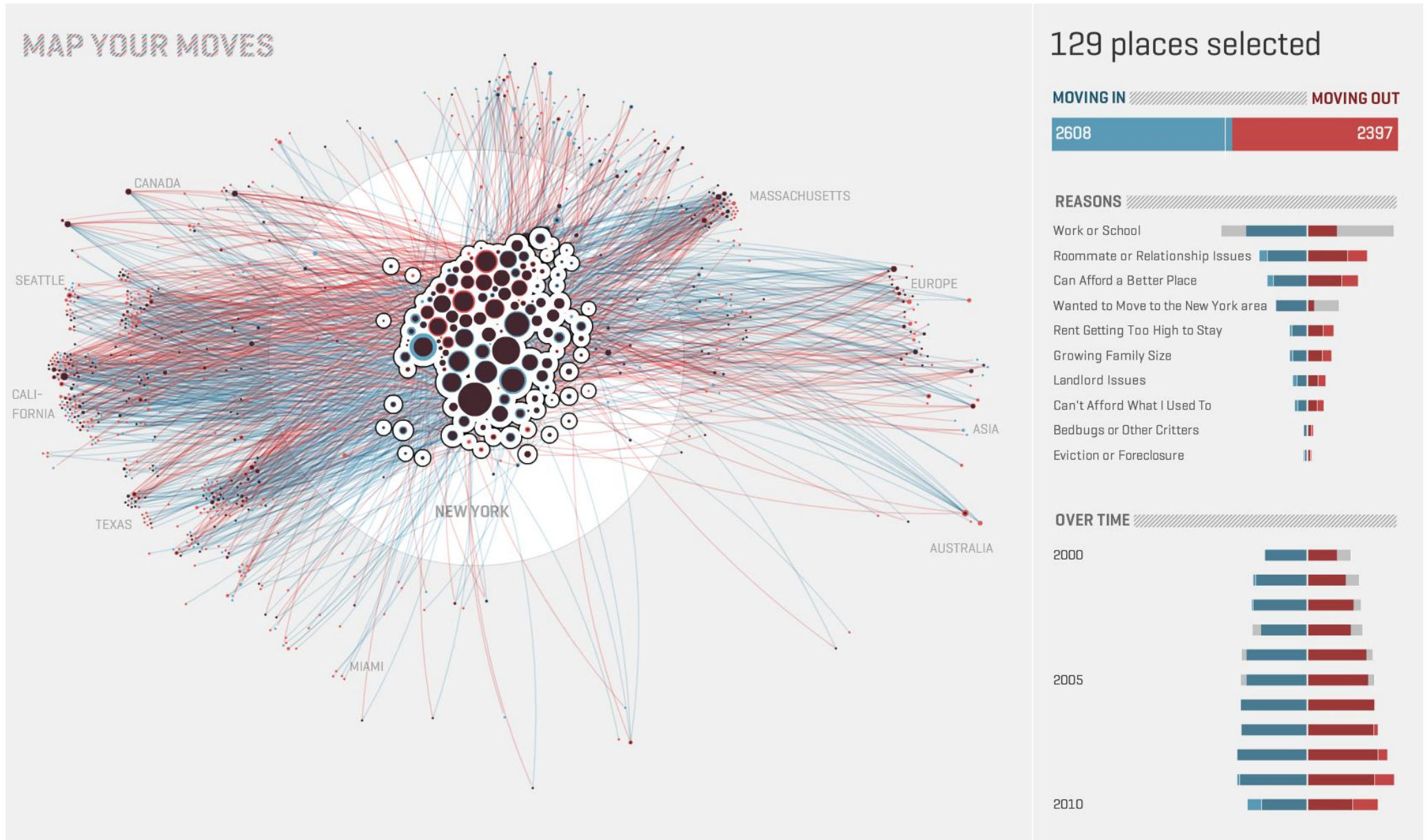
It was pleasing to find that the websites I chose to analyse met a variety of the requirements I had identified from my research. In further workings and perhaps in hindsight I would have liked to extend the analysis into the websites of mobile phone retailers rather than mobile phone manufacturers. This would have allowed me to further critique how they have met the needs of the user to understand the networks, tariffs and various limits available to them on a per device basis.

## Information Visualisation

I have analysed three approaches to displaying economic and environmental statistics via an interactive data representation. To break down the analysis I made use of the five steps identified by the visual literacy stairs of visualisation available at [http://www.visual-literacy.org/stairs\\_of\\_viz/stairs\\_of\\_viz.html](http://www.visual-literacy.org/stairs_of_viz/stairs_of_viz.html). Within that I assessed aspects of the visualisation which were suited to the step and identified relevant gestalt principles.

# Map Your Moves

<http://moritz.stefaner.eu/projects/map-your-moves>



# Measure of America

<http://www.measureofamerica.org/maps>

AMERICAN HUMAN DEVELOPMENT PROJECT of the Social Science Research Council

## Mapping the Measure of America

Maps Charts Stacks What is the Human Development Index? About Us

Life Expectancy at Birth (years)  
by States  
for ALL PEOPLE  
using 2010-2011 DATA SET

Find by zipcode Share this map Download data Reset map Normal notes

Add Colorado to Chart

Colorado: 79

81 -  
79 -  
79 -  
78 -  
77 -  
74 -

ENTIRE US

AHDP calculations using mortality counts from the Centers for Disease Control and Prevention National Center for Health Statistics, Mortality All County Micro-Data File (2007) as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Population counts are from the CDC WONDER Database July 1 2007 estimates (2008 Vintage). Data are for 2007.

### ALL PEOPLE Colorado

2010-2011 DATA SET

Human Development Index 5.65

Education Index 5.81

Life Expectancy at Birth 79 years

Median Earnings (2009 dollars) \$30,853

Educational Attainment

- Graduate Degree
- Bachelors Degree
- High School
- Less than High School

School Enrollment 87.49%

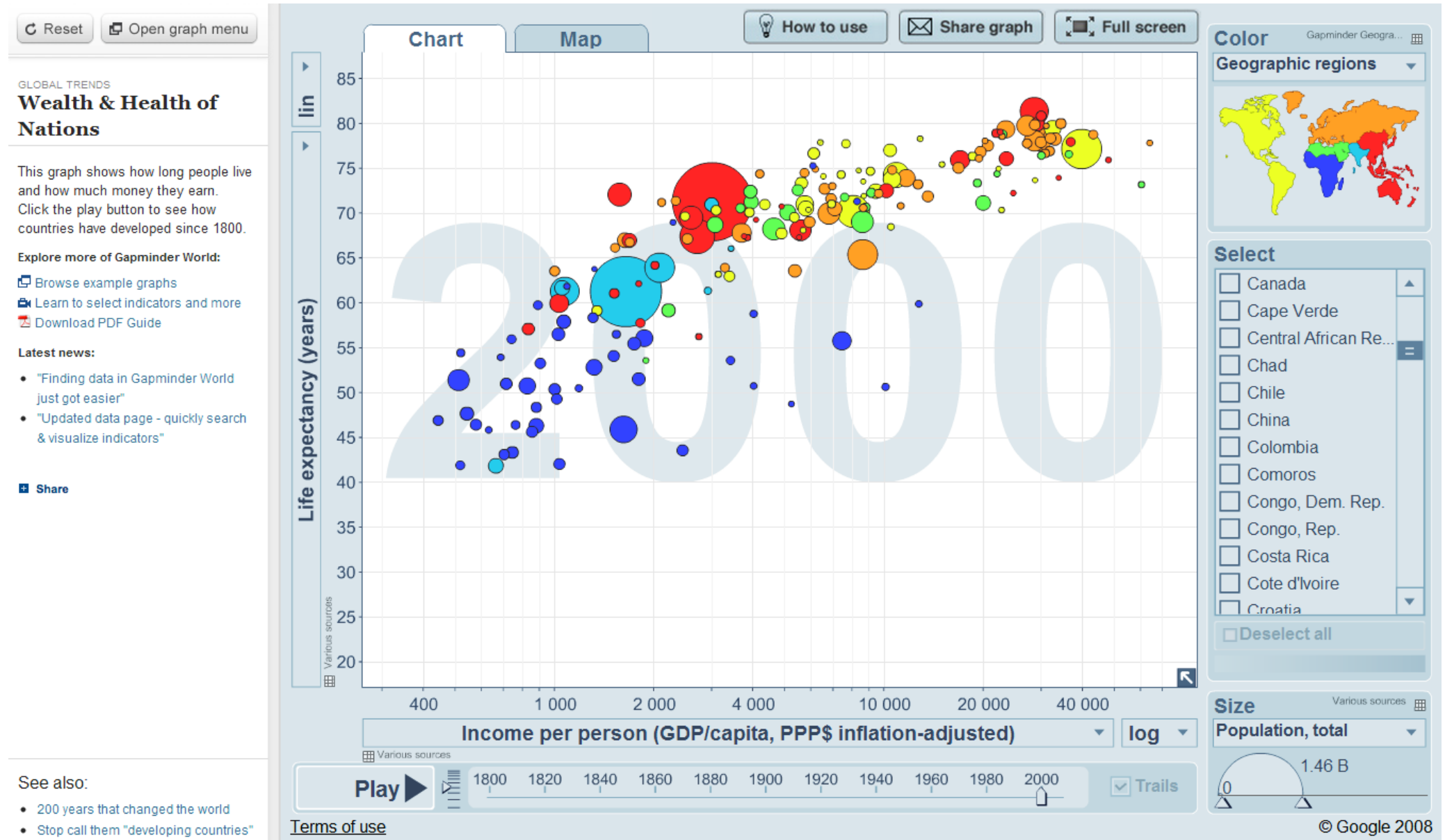
Race & Ethnicity *more info*

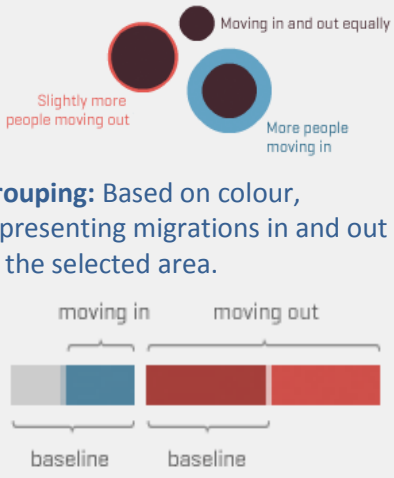

- White
- Latino
- African American
- Asian American
- Native American
- Other

Representation (2010)

- Governor
- Senate
- House

hide me



Website	Appropriate Picture Type	Using Retinal Variables Correctly	Respecting Design Principles	Avoiding Pitfalls	Innovating
<p><b>Map Your Moves</b></p>	<p>A non-geographical representation of states, countries and continents, showing migration patterns in and out of New York.</p>	 <p><b>Grouping:</b> Based on colour, representing migrations in and out of the selected area.</p> <p>Additional comparisons made possible by the use of a baseline for comparing the results from the area currently selected with the average from all of the data collected.</p>	<p><b>Closure:</b> The group zip codes are organised by state to provide structure.</p> <p><b>Continuity:</b> Reasons- ordered by importance. Users' eyes try to group states/countries into groups that one would assume as the shapes of the state/country- whilst this is not necessarily true.</p> <p><b>Contrast:</b> Blue vs Red, red logically representing migrations away (bad) and blue for migrations in (good).</p> <p><b>Proximity:</b> Dots representing zip codes of states are grouped together by state.</p>	<p><b>Alignment:</b> Ensuring distance is kept within reason, making distance non-relational where appropriate.</p> <p><b>Ambiguity:</b> Explanations are provided for any non-obvious visual content beneath the diagram. Although the circle surrounding NY/NJ? remains unexplained.</p> <p><b>Overload:</b> Avoided by focusing on New York as the central hub for the visualisation, and using only the latest information with data from previous years to the side.</p>	<p><b>Intrigue:</b> The 'visual exploration' is fun to play with, it encourages users to try selecting different samples and observe the results.</p> <p><b>Surprise:</b> The diagram allows for users to make comparisons difficult from other feasible representations of the date, such as assessing the frequency of migrations from minor states to Europe.</p>
<p><b>Measure of America</b></p>	<p>A geographical map of America, which is broken down into states by default and can also be grouped by congressional districts and other criteria.</p>	 <p><b>Grouping:</b> Based on colour, only one colour is used at once- which changes based on the topic group selected, and purple for everything else; the darker the shade the more the area has of the topic chosen.</p> <p><b>Size:</b> the relative size of the brain, heart and briefcase in this picture on the diagram changes based on the educational index, life expectancy and median earnings.</p>	<p><b>Closure:</b> States defined by their boundaries and highlighted on hover and when selected.</p> <p><b>Continuity:</b> States- ordered by their relative rank regarding the topic selected.</p> <p><b>Contrast:</b> The darker shades represent a larger quantity for that topic. Also, all health data is orange, education data is blue, and financial data is green- all other unclassified data is purple.</p>	<p><b>Ambiguity:</b> Each piece of information comes with a legend explaining the content, and a hover state for precise values.</p> <p><b>Overload:</b> Data has been put into context such as on the Race &amp; Ethnicity or Education Attainment 'grids', where numerical statistics are only shown on hover to aid simplicity and prevent overload, similarly for Representation.</p>	<p><b>Intrigue:</b> By collating so much information, trends can be assessed across any and multiple criteria, such as education index and energy conservation.</p> <p><b>Reframe:</b> The visualisation allows for advanced cross-state comparisons, especially through the chart functionality.</p>

<p><b>Gapminder World</b></p>	<p>Interactive graphs and maps that allows for the exploration of the world's statistical data.</p>	<p><b>Grouping:</b> Continents by default, customisable based on the same criteria available to the x and y axes, based on colour.</p> <p><b>Position:</b> Countries are position based on their ranking on the x and y criteria.</p> <p><b>Size:</b> Indicators are sized relative to the population of the country by default, customisable based on the same criteria available to the x and y axes.</p>	<p><b>Closure:</b> Country filters are available to the right, allowing the user to track specific countries, fading the others into the background.</p> <p><b>Continuity:</b> Clear trends / lines of progression can be identified from the graphs, representing the relationship between the axes.</p> <p><b>Proximity:</b> Indicator markers close together can be considered to be in a similar standing.</p>	<p><b>Alignment:</b> Linear axes by default, can be changed to logarithmic should the user take that preference.</p> <p><b>Ambiguity:</b> Legends and scales are provided alongside axes and anywhere where values are selected- most data sources are customisable, the only fixed data is time- which is clearly displayed on the background and definable via the slider at the bottom of the screen.</p> <p><b>Overload:</b> Country names, exact x and y values and size figures are all hidden unless the country or marker is hovered over.</p>	<p><b>Intrigue:</b> A great variety of trends can be assessed via the years of data covering a variety of statistics that can be plotted on the trendalyzer graph via marker colour, size and the two axes.</p> <p><b>Reframe:</b> The visualisation allows for advanced comparisons, of seemingly unrelated topics to assess trends.</p>
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## Review

This study into different methods of information visualisation has given me a valuable insight into how information can be displayed via means that are out of normal scope of basic tables and graphs. It is clear from the visualisations that I analysed that their means of rendering the information allows the user to perform a far more comprehensive evaluation of the data, and gain a greater understanding of how things relate and better assess trends in data.

It is clear from my analysis that the designers of these visualisations have taken the specific use-case scenarios for the data, and using design principles such as the gestalt laws produced visualisations that maximise the data's usefulness in order to provide a better experience for the end user. There is much to be learnt from their interpretation and implementation of these principles which I can apply to my own projects.

## Appendix

### Questionnaire

#### Consumer Purchasing Survey

This is my survey regarding mobile phone consumer buying patterns, if you could fill it out that'd be great! It shouldn't take more than a couple of minutes.

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##### Age Group

- Under 18  18-24  25-34  35-44  45-54  55-64  65 or Above  
 Prefer Not to Answer

##### Average Yearly Income

- Under £10,000  £10,000 - £20,000  
 £20,000 - £29,999  £30,000 - £40,000  
 Over £40,000  Prefer Not to Answer

##### How would you rate your technical knowledge?

- I struggle with technology  
 Average  
 I know my stuff

##### When did you purchase your current phone?

- 1-6 Months Ago  
 6-12 Months Ago  
 Over 1 Year Ago

##### How much was your phone worth when you bought it?

- Under £100  
 £100 - £200  
 £200 - £300  
 £300 - £400  
 £400 - £500  
 Over £500

##### How often do you buy a new phone?

- Monthly  
 Quarterly  
 Annually  
 Every 2 Years  
 Very Infrequently

**How did you get your last mobile phone?**

- Online Shop
- High Street
- Online Auction
- Friend
- Catalogue
- Upgrade

**Why did you choose to purchase from the location above?**

- Convenience
- Deal
- Price
- Sales Pitch / Expert Advice
- Choice
- Touch / Try before buy

**What was your reason for upgrading your handset?**

- Broken
- Outdated
- Bargain
- Features
- Lost
- Stolen
- Dissatisfied

**Other than calls and texts, what are the 3 most important aspects you look for when purchasing a mobile phone?**

- Applications
- Games
- Brand
- Camera
- Durability
- Style
- Interface / Usability
- Web Browser
- Price
- Music Player
- Battery Life
- Disk Capacity
- Positive Reviews
- Navigational Functionality
- Connectivity with Other Devices

**Phones4U Information**  
**Phone, Network & Tariff Summary**

(Attached)

**Phones4U Insurance Leaflet Extract**

(Attached)

## Tesco Phones Shop Christmas Deals

(Attached)

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