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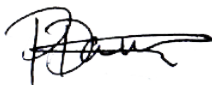
Disclosure:	I declare that this assignment is all my own work and that I have acknowledged all materials used from the published or unpublished works of other people. All references have been duly cited.		
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Introduction

Ingress [1] and Pokémon Go (PG) [2] are applications designed for Android and iOS mobile platforms developed by Niantic labs [3]. Both use GPS technology to create an augmented reality (AR) where users interact with game elements by navigating to different pre-programmed locations points of interest (POI) from the real world.

Although vastly different genres, both use the same underlying engine to power gameplay: Ingress being the predecessor to PG [4]. This report compares each game from a user experience (UX) angle. Firstly, a brief description is provided, followed by discussion of the impact of the apps, and different elements of UX the shared. Finally, a conclusion will draw on what has been learnt followed by a reference list and bibliography.

1.1 Description of Ingress

Ingress of science-fiction genre, originally released in December 2013 on Android platforms [5] and July 2014 on iOS [6] and re-released as Ingress Prime in November 2018 with an updated GUI and branding [7].

Ingress is a Massively Multiplayer Online Game (MMOG) game where users select one of two factions: the *enlightened* who believe that exotic matter (XM) is a force of good which can enhance mankind and the *resistance* who believe it to be malevolent, threatening mankind [8]. Each faction is battling XM: believed to be manipulating human minds unknowingly throughout history.

Users attempt to control XM by navigating to, and attempting to control, portals by attacking with resonators. Portals are POI in the real world: museums, architecture, parks or sculptures etc. [9], thought to influence human thoughts. The goal is to collaborate with a faction to control portals, creating more 'control fields' (links of controlled portals), earning more 'mind units' (population under control of that field), for your faction [8].

1.2 Description of Pokémon Go

PG, originally released in July 2016 [10], is part of the bigger Pokémon franchise owned by Nintendo [11].

Users, known as Pokémon Trainers, are required to navigate the augmented world catching and training Pokémon to battle each other with the ultimate aim of collecting all available Pokémon to become the best Pokémon Trainer [11]. Players can also collect and nurture Pokémon eggs which will hatch into Pokémon.

Poké-stops are real life locations on the AR map, such as, historical markers or monuments, where items like Pokéballs can be collected [12]. Reaching level 5 gains access to Pokémon gyms, where they can battle other players' Pokémon after joining one of three teams; Valor, Mystic or Instinct who each have a different ideology about Pokémon and their powers [13], [14]

1.3 Similarities and Differences between Ingress & Pokémon Go

The main similarity between the apps is the use and gamification of Google Maps; used as the underlying engine which each geo-game is built upon [15]–[17].



Figure 1 - Ingress Intel Map Showing Familiar Google Maps Interface [18]

Each game's individual layer is placed over the Google Map engine creating the AR, with Niantic's Brandon Badger [16] stating Ingress was a '*proof of concept*' for games of this nature:

the Ingress geo-technology to be used for future games, i.e. PG and the upcoming Harry Potter: Wizards Unite [19].

Niantic's original app using this technology was called *Field Trip* [20], with POI from this app used in Ingress and PG, along with locations submitted by users [21]–[23]. Users of both games reporting that POI used for Portals/Poké-stops match almost perfectly [24], [25]. Alexander [26] even reports that users state that Ingress's hotspots of XM relate to locations of rare Pokémon in PG.

Similarities	Use of GPS location services
	Underlying Google Map engine
	Portals/Poké-stops in same locations
	Players must interact with Portals/Poké-stops
	Both augmented reality games.
Differences	Pokemon is an Individual game, Ingress a multi-player
	Genre of games – storyline very different.
	User interfaces very different (although now similar with release of Prime)
	Ingress has two teams, Pokémon has three

Table 1 - Ingress & Pokémon Go Differences

Impact of Ingress & Pokémon Go

2.1 Target User Groups

Ingress – Sci-fi storyline suggests the target audience is mature adults, with an interest in physics/astrology and team capture-the-flag/strategy games. A 2015 survey by Winegarner [27] suggests the main user age groups are 25-34 (31.9%) and 35-44 (36.9%), supporting that it's aimed at older generations.

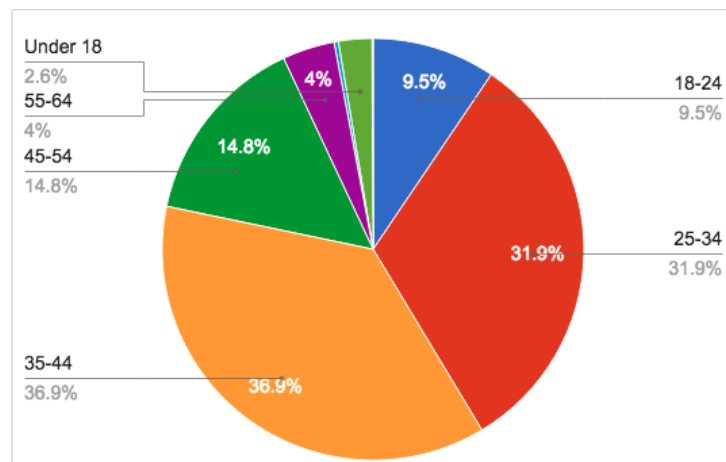


Figure 2 - Ingress Age Demographic [27]

Pokémon – The demographic is anyone aged 13+ interested in cartoons, wildlife (creator Satoshi Tajiri invented Pokémon to share his love of catching wildlife [28]), fantasy and AR location-based games. Since the franchise has been in existence since 1996 [28], evidence suggests the target audience has grown with Pokémon: most users (46%) being in the 18-29 age group bracket [29]. Sonders [29] adds the average user persona is: white, female, of 25 years, with degree level education and above average income.

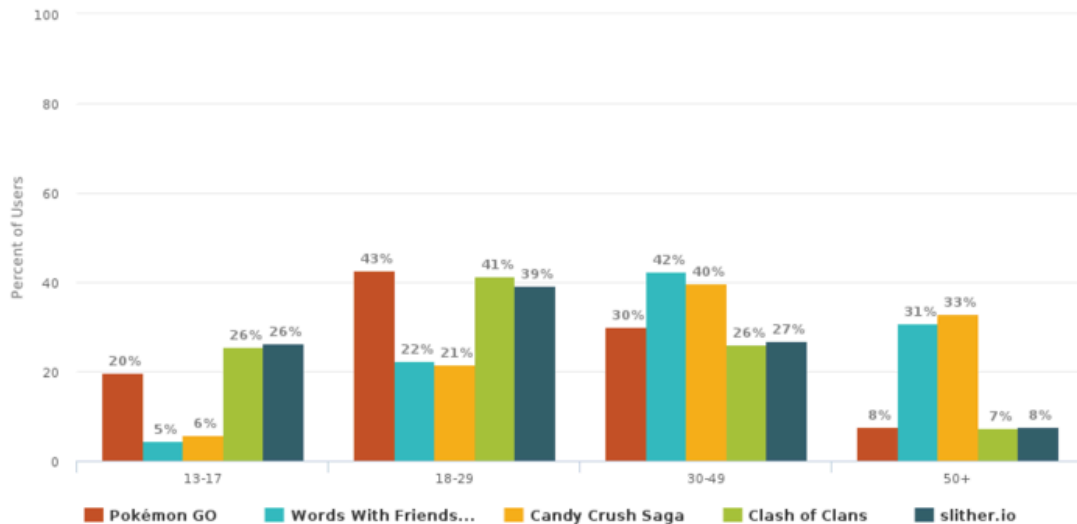


Figure 3 - Pokémon Go Age Demographic Comparison [29]

2.2 Game Interface Interchangeability

Ingress, identified as a precursor, or ‘proof of concept’ to PG means familiarity exists between the games, however, using Ingress after PG would prove uncomfortable, although switching from Ingress to PG would be intuitive.

PG follows the same format of navigating through AR and tapping on POI on a map, albeit with a different added dimension of catching Pokémon, but a vastly improved interface and tutorials throughout the gameplay lend themselves to a smooth transition from one game to another.

To highlight the discrepancies between each apps UI, and the difficulties users would have transitioning from Pokémon Go to Ingress, Nielsen’s [30] 10 UI heuristics can be applied and discussed.

	Pokémon Go	Ingress
1. Visibility of System Status	✓	✓/X
2. Match Between System & Real World	✓	X
3. User Control & Freedom	✓	✓
4. Consistency & Standards	✓	X
5. Error Prevention	N/A	N/A
6. Recognition Rather than Recall	✓	✓
7. Flexibility and Efficiency of Use	N/A	N/A
8. Aesthetic & Minimalist Design	✓	X
9. Help Users Recognize, Diagnose & Recover from Errors	N/A	N/A
10. Help & Documentation	✓	✓/X

Table 2 - Comparison of Apps to Nielsen's Heuristics

1. PG constantly communicates the system's status: a user created avatar is displayed prominently in the left corner of the screen with a progress bar indicating experience (XP) level. The user's character is surrounded by a pulsating circle, conveying feedback that the app hasn't crashed, and the range of which Pokémon can be caught. A cloud indicates weather conditions and a compass communicates direction. Banner notifications inform of nearby battles/events. This communication empowers knowledge which gives users control over the system [31]

Pokémon continues communicating status through gameplay: Pokémon are prominently displayed when they appear, surrounded by pulsating circles drawing a user's attention promoting understanding. Furthermore, the act of catching Pokémon is appropriately communicated. These communications build up a relationship with the user, encouraging trust [31].

An annotated screenshot is shown in figure 4 on the following page.



Figure 4 - Pokémon's Interface Communications

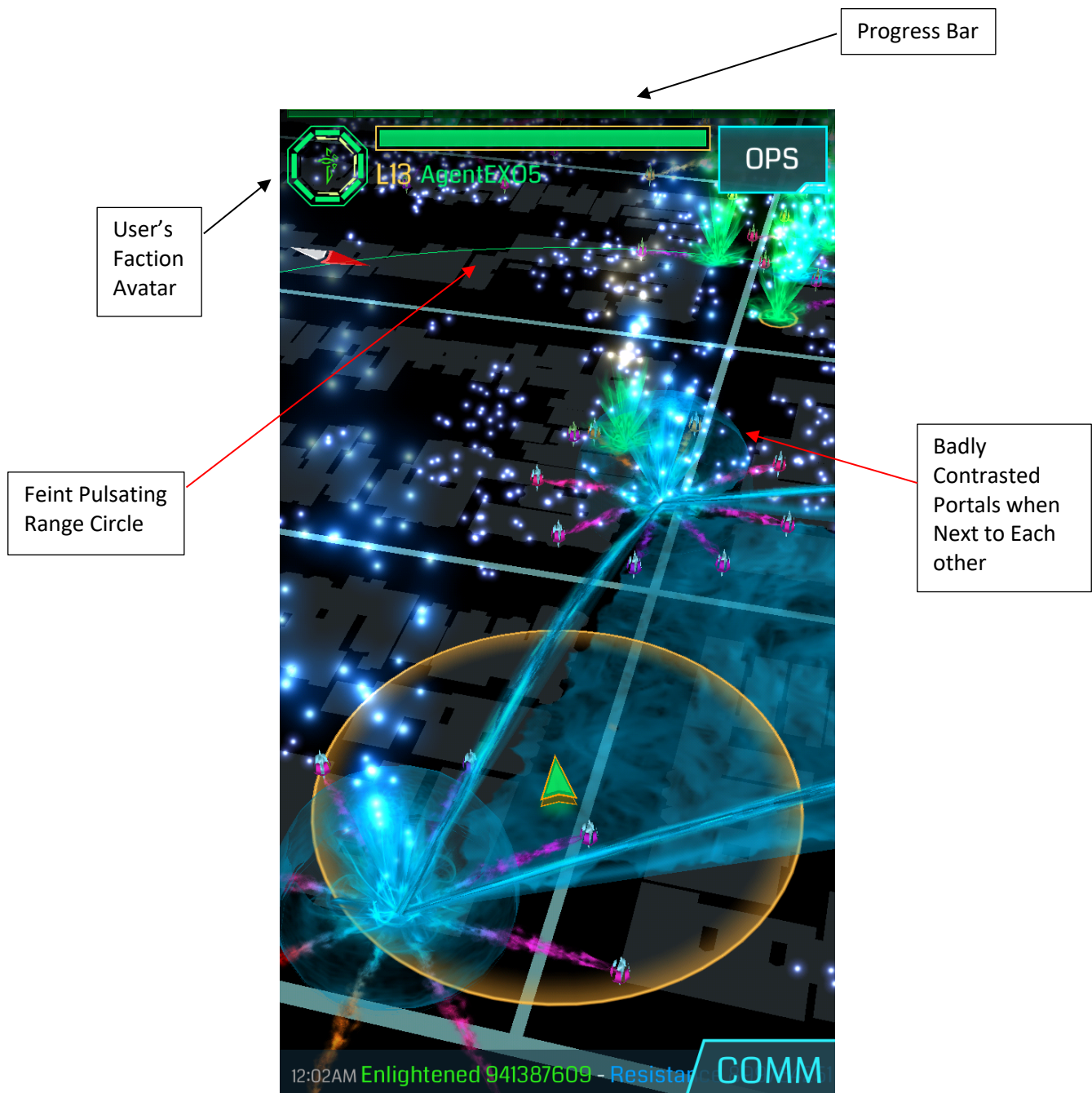


Figure 5 - Ingress's Interface Communications

Ingress communicates its system status poorly, although the UI displays a prominent XP level progress bar, the avatar chosen by faction. The range circle does pulsate, but with a larger, faint, unnoticeable pulse spread across the map. Portals are prominently displayed, with each faction's colour prominent, however, when close together, distinguishing them is difficult.

When attacking a portal communication of node health is poor, after many attacks it is unclear as to how many more attacks are needed to control the portal. With an average limit of 10 seconds for keeping a user's attention [32], users are frustrated and feel unrewarded, and may feel justice is not being done, discouraging them from returning.

2. Although an AR game, users find comfort in familiarity, and matches must be found between AR and the real world [33]. Apart from Pokémon names (which users still find familiar due to franchises longevity), the language used is plain English and the concepts like reality.

Ingress' language, by contrast, is less familiar: confusing throughout the game. Button labels such as 'COMM' and 'OPS' are confusing abbreviations and features include 'exotic matter' and 'control fields. Being a sci-fi game certain users will find familiarities with this language, but for most it's unintuitive and forces users to think about each move, contradicting Nielsen's and Krug's fundamental principles of UX [34], in turn leading to users missing features of the game.

3. Both apps allow users good control and freedom with clearly displayed exits from menus etc. Additionally, the iOS and Android platforms allow for simple exits from the game.

4. Neither app follows any 'standardised' conventions, however, when considering the menu interface, PG menu is far more intuitive: it's location familiar and uses instantly recognisable icons from the franchise and standardised language, unlike the words used by Ingress (2.)

Since the release of *Ingress Prime*, PG menu conventions could now be considered a 'standard' for Niantic: prime now utilising a PG style interface. Nielsen [35] states designers should '*design for patterns which users are accustomed*', and PG is arguably what Niantic's users are accustomed to, with over 700 million downloads in 2017 compared to Ingress' 20 million [36]. Krug [34] agrees, adding that standardising interfaces helps users locate things quickly and

reduces frustration. The use of conventions will see users transitions to Ingress from PG more comfortable.

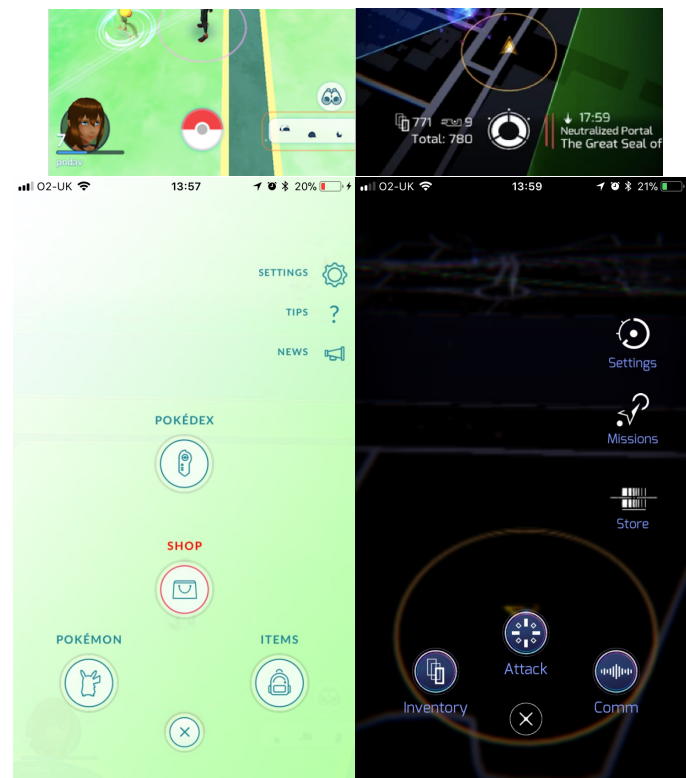


Figure 6 - Pokémon & Ingress Menu's

5. Error prevention is not applicable to either app.

6. Nielsen [30] states recognition is better than recall, with Budiu [37] adding that recognition is one of the top usability heuristics. Both apps make objects, actions and options visible, however, PG achieves this aim better through a better UI, however, with Ingress Prime following conventions of PG, users will find Ingress Prime's interface recognisable.

7. Accelerators speed up interaction for expert users but the system must cater for both experienced and inexperienced user's [30]. PG has 6 accelerators [38], Ingress has none so experienced users must interact the same way as beginners providing less of a status reward for prolonged service. Ingress Prime has since fixed this adding shortcuts to the interface [39].

8. Ingress ignores Nielsen's [30] 8th heuristic of aesthetics and minimalist design. Bright and badly contrasted neon colours over a black map which retains 2D geological detail (buildings etc.) with control fields randomly scattered, surrounded by white specs of XM, lend to a

cluttered, confusing gameplay interface. In contrast, PG removes geological detail, displaying only relevant information: Pokémon, Poké-stops and Gyms. Babich [40] highlighting importance uncluttered interfaces, especially on mobile devices, stating that clutter reduces comprehension, with Krug [34] adding that clutter or 'noise' obscures important features, which in turn reduces adoption of apps.

9. Error messages are not applicable to either app.

10. PG guides users from the beginning and to each time they play, increasing understanding and avoiding pain: tutorials lead users through the concepts and controls of the game upon first use and notifications display help messages throughout. Interaction with fellow trainers leads users on challenges and tasks, in addition web documentation is available.

Ingress' opening tutorials are poor, with no explanations of why things are the way they are, resulting in poor understanding and learning pain something which has been accredited to users not adopting Ingress for long [41]. However, Ingress does pop-up messages upon initial use to explain what buttons do with eBooks and a YouTube channel available, although navigation away from the app is required.

Conclusion of Section 2.2

Mapping Nielsen's 10 usability heuristics shows how users would find transitioning from PG to Ingress uncomfortable due to poor usability, however, users of Ingress would find transitioning to PG comfortable, firstly, due to the familiarity of the AR location-based game genre, and easy to learn interface as the PG interface scores positively with every defining quality component of usability by Nielsen [42]. Additionally, Pokémon matches user's 14 universal emotions [43], far better than Ingress.

Niantic recognised problems with Ingress and have strived to address them with Ingress Prime. Firstly, Ingress Prime uses technology used in Pokémon Go: a Protobuf [44] network layer preferred to JSON [45] to enable use of Apple's ARKit [46] and Google's ARCore [47] technologies. Additionally, updated visuals (fig. 6) and interface accompany a more in-depth storyline, better tutorials, inventory management, easier defence and attack and sounds, and a portal map laid over a real world map, which again is a prototype for future features in PG and Harry Potter [36], [41], [48]–[50].

Despite these improvements, Sholtz [51] reports that core users were unhappy with the update, in response, Niantic re-released the original Ingress as *Scanner [REDACTED]* [52]. The disdain of original Ingress users at the update could be because humans do not like change, change can be seen as a painful emotion. Additionally, decreased sophistication of the game and its interface brings Ingress users down to the level of PG users, something which clashes with their views on affiliation and status.

2.3 Use of Ingress & Pokémon Go

2.3.1 User Numbers & Length of Use

Pokémon Go – Release of PG saw Niantic's servers crashed through demand for the game worldwide [53], [54] although some reported the crash was due to a malicious attack [55]. Since 2016, there has been a reported 700 million+ downloads, billions made in revenue [56], [57] and at its peak in 2017, PG had 28 million daily users which has since declined to a still impressive 5 million daily [58]. Analytics firm SuperData [59] add that in May 2018, the game had 147 million active users, more than at any time, with SimilarWeb reporting that each user spends an average of 43 minutes playing PG [60], [61].

Ingress – The 3-year report, in 2015, showed download statistics of 14 million [62]. The 2017 report showed total downloads of over 20 million, with 1.2 billion portal visits and 427m kilometres walked by users and over 450,000 visiting Ingress events called an 'Anomaly' [63],[64], proving the game still had relevance, despite PG success. Actual usage statistics are scarce: Ingress never releasing official figures. John Hanke, Niantic's CEO, revealed the company is '*only focused on the number of downloads*' [65], however, Goel [66] of the New York Times reports 1 million active users worldwide in 2016, with others user speculating that monthly user numbers are around the 300-500 thousand mark [67], [68].

2.3.2 Social Familiarity & Acceptance of AR Features

Although AR first appeared in the 1950s [69], Ingress and PG were the first AR game experience commercially available to become socially accepted.

Carmigniani [69] states that success of AR systems relies on implementation on devices which are socially and fashionably acceptable and natural to interact with. Ingress and PG are available on the most socially acceptable devices of modern times: iOS and Android smartphones and tablets. These devices are now commonplace in society, with their features familiar with their users: touch screen interfaces, cameras, haptic feedbacks etc. This familiarity aids in the success and acceptance of AR features, giving users familiarity to what should be a very unfamiliar past-time; exploring your local area, attacking and controlling portals for XM or catching rare mythical beasts.

However, the increased social acceptance of this technology, and AR games in particular, is not always a good thing. There have been reports of PG players disregarding their safety and the safety of others, one BBC report stating the game has led to car crashes, muggings and death [70], whilst others report that the game was used to lure users to a location to rob them at gunpoint and a Russian man was jailed for three and half years for catching Pokémon in a church [71]. Perhaps this technology is becoming *too* socially acceptable for its users and very un-socially acceptable for its critics.

Ingress is no different, with the same problems plaguing its users, Cross made reference to Wingarner, reporting that a male user of Ingress used the game to stalk another female user [72]. Hulsey and Reeves [73] state that Ingress is “*the gift that keeps on giving*” in terms of surveillance and data mining, adding that users trade datafication of their mobile life in payment for the gift of play, something which applies to PG, too.

It is not just personal data that users pay with, a Lottoland poll suggest that PG users spend an average of £40 on the app [74] with Ingress users spending an average of £61 (\$79) on playing [75]. Given the enormous revenue that Niantic amasses through data, charging users for extras may seem unethical.

There are even reports of PG and Ingress being ‘racist’, with more Pokétops and portals being placed in predominantly white areas, with researchers finding an average of 55 Pokétops in predominantly white neighbourhoods, compared to just 19 in black or Hispanic areas, however, Niantic defend this by stating that this is a result of Ingress, the precursor to PG, being crowdsourced from predominantly male, tech-savvy players resulting in high

concentration of portals/Pokéstops in commercial and downtown areas, white are predominantly white [76].

Elements of User Experience

Marsh [43] states there are five main ingredients of UX: psychology, usability, design, copywriting and analysis. The following section of the report will use Marsh's theories to compare and contrast UX elements of PG and Ingress.

3.1 Psychology

As Niantic's location-based AR games were a new phenomenon to smart-phone users both Ingress and PG appealed to users both intrinsically by playing on humans curiosity and love of accepting new challenges, and trying new things, and extrinsically by way of needing to be affiliated, accepted and understood by others (friends/family etc.) who already play the games [77], [78], part of the '*gaming family*' [79]. This affiliation may lead to increased social activity among gamers, forcing them to be less sedentary and meet other gamers, possibly leading to creation of friendships, some users possibly motivated by sex, building up relationships with like-minded gamers. Additionally, users of both games have been found to be motivated by exercise, a homeostasis balance: studies on both games report that users have positive experiences with the games resulting from increased exercise [80], [81].

Fun, escapism, nostalgia (PG), friendship are alternative motivations mentioned in reports for Ingress and PG, however, achievement stands out as a common psychological factor with users motivations quoted as, '*amassing massive amounts of damage*' [80] for Ingress and '*to beat the gyms and dominate my local area*' [79] for Pokémon. Both extrinsic motivations, giving a feeling of status for playing. Niantic works on the basic human trait of competitiveness where humans are rewarded for achieving and delivering justice and in some cases, protection of lesser players: capturing/defeating all the Pokémon or hacking/capturing/protecting portals and becoming the 'best'.

These motivations will keep users returning to play. Exercise returns feelings of good health (homeostasis)[82], acceptance returns feelings of affiliation, belonging and status [83], fun returns feelings of enjoyment, escapism avoids pain and death by replaces boring or unpleasant parts of life [84], nostalgia increases self-esteem and generates positivity [85] and achievement fuels feelings of pride and pleasure [86]. Each positive feeling a 'reward' for users, leaving positivity associated with each game [43]. However, Niantic could be accused of designing behaviours for dark purposes with huge profits made from each app: users required to purchase more 'fuel' (pokéballs, resonators etc.) to avoid not belonging or

affiliated. Ingress have even teamed up with AXA insurance to advertise in-game [87] and both apps are seen as 'data' gold mines [88], [89].

The games also conjure up feelings of frustration, whether it be Pokémon breaking free, or evading your pokéballs, or portals resisting takeover. This is where Pokémon shines over Ingress, users are treated to their 'first taste' of catching Pokémon instantly, conditioning the upcoming addiction [43] and creating a rememberable and easily learnt habit. Ingress, however, involves far more work to takeover a portal: 16 XMP blasters used and 3 minutes later and portals still resist. This type of punishment and pain creates negative emotions, leaving users unwilling to return [43].

PG also triumphs with its tutorials: simple and to the point with correct language increasing understanding. Ingress, however, uses complicated language, and a complex storyline which is difficult to follow, however, some users who do understand Ingress may feel a higher status than those who don't, although, the release of Ingress Prime saw improved storyline and tutorials, however, they are long winded and still of a confusing language, which means they may be ignored [34] and overwhelm users [90].

3.2 Usability

Achieving the main goal of catching Pokémon is simple and learnt quickly, on the contrary, capturing portals is painful and time consuming, with linking them even more difficult. Selecting weapons is tricky and time-costly to learn, and there is no feedback from the game to whether or not the best weapon is being used to attack portals. Mistakes like this could be prevented by keeping the users informed with clear, well labelled buttons and instructions [43].

The menus of both do not conform to affordances of visual cues, with PG menu accessed through a Pokéball icon and Ingress's through a button labelled 'OPS', neither app prevents users from thinking unnecessarily [34], both being too 'clever' in design. However, Niantic has learnt lessons, and used PG menu system as a convention for use in Ingress Prime.

Due to familiarity of the franchise, the gameplay of Pokémon works with user's assumptions through the act of catching, training and fighting Pokémon as this has not changed since its conception with users associating feelings of love with Pokémon. However, losing battles,

eggs not hatching and losing Pokémon when they break free or run away works against assumptions, but this keeps the game interesting. Ingress works in a similar way; however, it works against assumptions too much: reaching higher levels is difficult and time consuming having the opposite effect.

Controls of both games are rememberable, especially with Ingress Prime, however, with Ingress's more complex storyline, remembering every control would consume more cognitive thought.

3.3 Design

Without good design users will not trust or understand apps [43]. Pokémon uses design conventions which are instantly recognisable by existing franchise fans, communicating its purpose and function instantly with trust of the app ensuing, which also extends to Ingress Prime following the update of the menu: users finding familiarity in Niantic's new brand representation. However, Ingress has no franchise to support its trustworthiness, and the colours used give a 'cheap' feel to the app, however, this is due to the futuristic genre and although cheap looking, communication of its purpose as a sci-fi capture-the-flag game is good.

Ingress's interface design lends itself to conventions well, the eye is naturally drawn to the top left corner of any screen/document (western civilisations) [87], [91] where a menu lives, however, the menu icon isn't obvious. A status bar leads your eye across the screen to another badly labelled menu, 'OPS', the eye is then drawn to the final badly labelled menu in the bottom right and corner 'COMMS'.

Pokémon by contrast ignores conventions with the first icons placed in the top right corner, the eye is then lead down to the bottom right, and across the screen to reveal the remaining menus, however, none are obviously menus or buttons. The overall colours, shapes and typography used hinders the usability on both, as do the indistinguishable buttons, however, they do encourage curiosity to explore: modern day users of smart devices are less afraid to discover what is and what isn't a button or feature as they are socially familiar with safe exploration of these interfaces as accessibility and satisfaction to these devices have a positive effect on cognitive trust [92].

3.4 Copywriting

Marsh states that UX should make effective users, not happy ones, meaning that Niantic's goal should be to make users understand [43]. Pokémon confidently achieves this, users understand their goal through initial tutorials by Professor Willow who further guides users as they progress through well presented, clear text using simple fonts and contrasting colours.

Ingress's goal is not clearly defined, a deep storyline told through badly contrasted colours and flickering screen do well in delivering dramatic effect but confuse users. However, initial gameplay is accompanied by clear instructions on portals, attacking, hacking and creating fields, writing in clear font and contrasting colours.

Conclusion

Ingress and PG provide a satisfying UX to their users, however, PG provides a better experience through improved design, usability, copywriting and plays on user's psychological needs and motivations.

Niantic has clearly learnt lessons from Ingress when implementing PG, and Ingress was always a prototype to prove the concept of location-based AR games. Niantic has continued learning from PG and has applied knowledge into Ingress Prime where it continues to prototype beta features, like the real-world map for use in its future titles. Niantic also planning to set up an API called the 'Real World Platform' where their AR platform would be available for developers around the world to create apps using their technology [93].

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Appendix A (Abbreviations)

Abbreviation	Meaning
AR	Augmented Reality
GUI/UI	Graphical User Interface / User Interface
GPS	Global Positioning System(s)
MMOG	Massively Multiplayer Online Game(s)
OS	Operating System(s)
PG	Pokémon Go('s)
POI	Point(s) of Interest
UX	User Experience
XM	Exotic Matter
XP	Exotic Matter
Ingress/Prime	Unless stated at Ingress Prime, Ingress refers to Ingress 1.0