

A Virtual World Game For Natural Language Annotation

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Abstract

In this paper we introduce *LingoTowns*, a new GWAP platform targeting language learners. *LingoTowns* provides a unified experience integrating games for multiple aspects of lexical and grammatical competence in a single virtual world, whilst simultaneously collecting judgements. Both *LingoTowns* and its constituent games are designed to provide more engagement to the players/ learners than previous GWAPs for NLP. The platform also incorporates progression methods ensuring that the players' progress in terms of understanding of grammatical concepts is tracked both at the individual game level and overall.

Introduction

Games with a Purpose (GWAPs) for different types of data labelling (Von Ahn 2006; Lafourcade, Joubert, and Le Brun 2015) have been under development for over twenty years, but while in some domains GWAPs have fulfilled their promise of leveraging the web population to label vast amounts of data at low cost (one obvious example of successful GWAP being *FoldIt* (Curtis 2015)), others have proved more challenging. NLP, in particular, is an area in which GWAPs have demonstrated great potential (Lafourcade 2007; Poesio et al. 2013), but are yet to rival the success seen in other domains.

In this demo paper we present *LingoTowns*¹, a new GWAP platform for smartphones that targets language learners but also addresses other limitations we have come to recognize in fifteen years of work with *Phrase Detectives*.

Firstly, unlike most NLP GWAPs, *LingoTowns* integrates multiple games for many aspects of language interpretation, each with their own features and interface, designed specifically to suit their respective annotation tasks. NLP annotations typically require annotating multiple interdependent levels (e.g. *token boundaries* → *part-of-speech* → *mentions* → *co-reference*). **Gamifying the entire pipeline** could improve the quality of the collected data and make it possible for grammar learners to learn and be evaluated about different aspects of grammar. To our knowledge, only one platform has a similar type of approach, *WordRobe* (Venhuizen

et al. 2013), whose design differs from that of *LingoTowns* in that a single game design is used for all types of annotation.

Our second key objective was to make the platform as **entertaining and game-like** as possible. For *LingoTowns* as a whole, we looked for an overarching game genre that would not break player immersion, thus providing a lot of freedom and flexibility for the designer of the mini-games. We settled on the **virtual word** paradigm (Bartle 2004), which provides the opportunity to inject a sense of exploration, fantasy and agency into the design of GWAPs. We also used **procedural content generation** to ensure the players would have access to infinite content.

The third key objective of *LingoTowns* is to incorporate both **progression** and **task assignment** strategies. Effective task assignment strategies are a very important element of human computation systems. However, in addition to accuracy, GWAPs also target entertainment and the same progressive experience used by games (Madge et al. 2019b). In this work, we centralise the progressive task-assignment between multiple tasks. This approach provides the opportunity to explore methods of progression between games and annotation tasks that allows us to strike a balance between delivering: an entertaining experience; an educational experience and an optimised strategy for the final accuracy of the annotations.

LingoTowns

LingoTowns is a web based, infinite, procedurally generated isometric world. Each town is associated with a single document, and each building in that town represents a single annotation activity/game.

The experience is presented as an isometric view of a world, as in Figure 1. The world layout is coupled with the task assignment. The player is motivated to complete tasks partly through the agency and freedom it gives them to continue to explore the world. As a consequence, the world is “infinite”, locations can be dynamically added in-line with the players progression and the requirement for annotations through procedural generation. The levels are laid out in concentric circles on the map, from the “home position” at the very centre of the map, moving outwards with increasing difficulty (Figure 3). Levels are split into towns for each document, with different themed biomes (e.g. Farm, Desert,



Figure 1: The *LingoTowns* World Map

Woods), shown in Figure 1.

To accomplish this procedural generation, methods including Poisson Disc sampling (Cook 1986), Voronoi segmentation (Aurenhammer 1991), Perlin noise (Ebert et al. 2003) and A* search (Hart, Nilsson, and Raphael 1968) are used (strategy depicted with top down perspective in Figure 2).

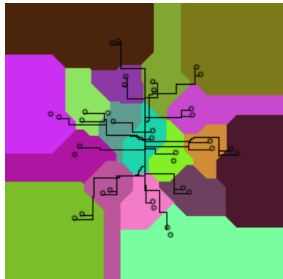


Figure 2: Layout Generation (biomes: coloured regions; roads: lines; buildings: circles)

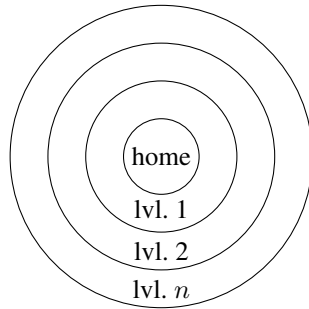


Figure 3: Game World Layout

In *LingoTowns* the **progression** is centralised, with *LingoTowns* deciding which document the player will see in each game. This arrangement allows us to address the cross-cutting interests of supporting learning between multiple tasks, maintaining player high engagement and gathering the annotations that are most needed. To achieve this we explore combining methods such as knowledge tracing with information theoretic methods derived from the aggregation.

LingoTowns is designed to support easy inclusion of **third party games** which can be played as part of *LingoTowns*, or independently. Currently, there are three sub games, namely: *CafeClicker*, a game for labelling part of speech tags; *PhraseFarm*, a game for labelling noun-phrases and *Lingotorium*, a game for labelling coreference. These games are an evolution of previous *WordClicker* (Madge et al. 2019a), *TileAttack* (Madge et al. 2017) and *Wormingo* (Kicikoglu et al. 2019) respectively. The developments in the new games are the product of an in-depth user-study that focused on the player experience and user interaction.

*CafeClicker*² (Figure 4) is a game for labelling part of speech tags, but could be expanded upon more broadly for annotation of lexical categories in general. The focus of the games changes following the user-study are largely related to clarity of feedback and cosmetic items.

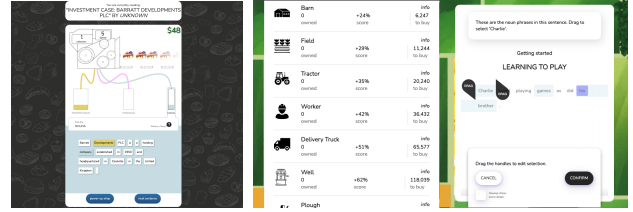


Figure 4: *CafeClicker* Figure 5: *PhraseFarm*: Gameplay/Tutorial; Shop

*PhraseFarm*³ is a game used for noun-phrase annotation, but may be applied to any segmentation task. *PhraseFarm* features a new text segmentation interface and detailed feedback on the annotations they provided in comparison with the annotations that we currently hold to ensure they continue to have a good understanding of the task as the complexity increases (Figure 5).

*Lingotorium*⁴ serves as the final node of the *LingoTowns* pipeline, providing the annotations for coreference. *Lingotorium* follows what we call the “motivation/annotation” paradigm (Kicikoglu et al. 2019), where players solve various word game-like puzzles (Figure 6) and annotation tasks back-to-back.

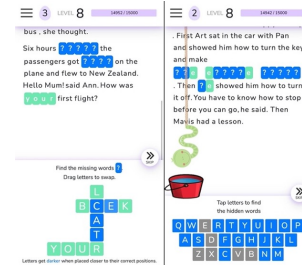


Figure 6: *Lingotorium*: Motivational word puzzles

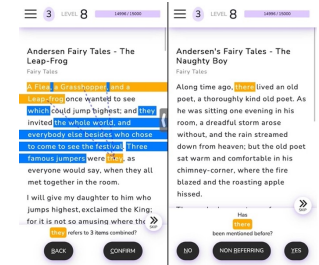


Figure 7: *Lingotorium*: Annotation

Conclusion

In this work we have discussed our approach to organising multiple GWAPs to form a cooperative effort to annotate documents. *LingoTowns* serves as a base for exploring multiple concepts, including progression, motivation and gamification between multiple tasks and documents. We hope to collaborate with other GWAPs that to extend the existing natural language processing pipeline adding more games. In further work we will discuss the results of our approach on annotation and player enjoyment, and introduce new methods of progression and game-like motivation that build on the *LingoTowns* base. In the long term we hope to be able to release multiply annotated corpora from *LingoTowns* for supervised learning and study.

²<https://cafeclicker.com>

³<https://phrasefarm.org>

⁴<https://lingotorium.com>

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