Procedural Generation of Linguistics, Dialects, Naming Conventions and Spoken Sentences

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INTRODUCTION

This exploratory paper on a work-in-progress game development explores the design implementation and thematic and gameplay objectives of a system for the procedural generation of forms of speech, dialects, and even unique idiolects distinctive to in-game individual AI actors. It begins by recounting the development of the five-year ongoing experimental roguelike game project this system was created for, *Ultima Ratio Regum* (*URR*), and identifying the literary inspirations behind the project which have strongly informed the in-development language, speech and dialect system. It then notes the importance of what I term "qualitative procedural generation" to this project – the algorithmic creation of cultures, social norms, practices, beliefs, etc – and how these many factors underpin the procedural creation of the game's dialects for various cultural groups. It then goes into detail about the variation introduced into the speech system, including syllabic and alphabetical variation, the creation of sets of references for each culture dependent upon a culture's geographic and climatological location and ideological and religious preferences, the procedural generation of names which adhere to different archetypes, and the generation of greetings, insults, farewells and compliments distinctive to each culture. These are in turn combined with variations in sentence complexity which the paper also considers. The paper then offers two sample conversations from the in-development system, and explores the potential of such cultural speech systems for the generation of deep and highly believable virtual worlds, especially in games (such as *URR*) with an explicit focus upon simulation or worldbuilding. At time of writing this system is two months into a predicted four-month development, and the finished version will be demonstrated at DiGRA-FDG 2016 alongside the presentation of this paper. In keeping with the author's background in social and political science, not in computer science, this paper focuses upon questions of system design and player experience, rather than the technical specifics of the system's coding implementation.

ROGUELIKES, ULTIMA RATIO REGUM, INSPIRATIONS

Procedural generation is most famously seen in the "roguelike" genre. The term "roguelike" derives from the seminal procedurally generated dungeon-crawler Rogue (1980), and roguelike games maintain the major components of this original (Johnson, 2015a): the procedural generation of level spaces, generally turn-based gameplay, a very high level of complexity and a correspondingly large possibility space of in-game

Proceedings of 1st International Joint Conference of DiGRA and FDG

interactions, and "permadeath" (characters cannot be reloaded if they are killed). Most roguelikes do not have "modern" graphics, but rather utilize a graphical style based on the use of textual and numerical symbols (Garda, 2013; Mäyrä, 2008). This style has endured despite substantial improvements in the potential detail of computer graphics in decent decades (Diaz, 2009; Parker, 2014), and despite the difficulty that some players encounter in reading and deciphering such visuals (Johnson, 2015b).

Ultima Ratio Regum ("the last argument of kings") is an experimental roguelike game currently in development. It aims to integrate thematic content on historiography, philosophical idealism and the rise of modernist grand narratives, with the deep, complex and challenging gameplay one expects from a "classic" roguelike, whilst also maintaining much of past roguelike games. Set around the Scientific Revolution, the player is tasked with discovering a conspiracy via identifying procedurally-generated clues hidden throughout the world's cultures, religions and societies; the game features extensive procedural generation of everything from tombs and religious altars to (in the near future) paintings and sculptures, any or all of which may contain the clues required in a given playthrough. Development began just before the first year of the author's doctoral research, and the game is now a little over half finished. The primary inspirations are drawn from literature, especially the work of Umberto Eco on the intellectual currents of the middle ages and the risks of apophenia in the creation and spread of conspiracy theories, Jorge Luis Borges on labyrinths, mazes, puzzles, infinity, and the (re)writing of history, and Italian literary collective "Wu Ming" on cross-cultural contact in historical contexts, the politicization of religion, and the flows of power in pre-modern societies. Given the game's focus and inspirations, much of its procedural generation is not about the spatial layouts of regions or buildings (although these are present), but rather in political and social concepts. The author is an academic sociologist, not a computer scientist, and found the very small number of games which do try generating these concepts to do so in tremendously simplistic ways that, to a professional social scientist, offer nothing more than surface detail which leaving the true fascinating complexities of social behaviour – and the intriguing potential of such a field for procedural generation – entirely untapped. This is the primary omission in game design and procedural generation that *URR* was designed to address, and one component of this is the PCG dialect system.

Figure 1: a small portion of the procedurally-generated clothing styles possible within the game. These serve to offer visual distinction between different in-game cultures, and are related to the "style" of civilization to which they belong – feudal, nomadic, tribal, etc.

At time of writing, in the upcoming release the player can explore a vast world of civilizations of various sorts, meet tens of thousands of procedurally-generated individuals whose behaviour is structured by their cultural practices and religious beliefs, view a range of procedurally-generated ASCII/ANSI artefacts, and explore buildings ranging from cathedrals to castles and barracks to gladiatorial arenas. The most important recent development which influences the dialect system is the implementation of procedural cultures, religious beliefs, social norms, practices, and other anthropological and sociological concepts, which are reflected in every item and building found in the game. As these concepts are generally non-physical, the game generates items of material culture through which these abstract concepts may be recognized by players (Figure 1; Figure 2). These lay an easy and obvious foundation for players overwhelmed by the many cultures depicted in a generated world, and have also become emblematic of the game's visual style. However, the focus of this paper is on a particular non-physical component of the games' cultures: culturally-particular dialect and speech generation.

Figure 2: twelve out of the approximately 50,000,000 possible religious altars. As with clothes, these are designed to give "solid" visual recognition to a massive range of possible religious beliefs, serve as signifiers between different religions, and in turn influence the style of other cultural items, such as prayer mats.

PROCEDURAL DIALECTS

The game now contains an in-development system for the procedural generation of linguistic dialects, distinct to each in-game nation and significantly varied across each playthrough. This was implemented in order to challenge the prevailing forms of conversations with AI actors in most games – mechanistic interactions, repeated identical statements, and AI actors who all behave in comparable ways. By implementing a dialect system AI actors are readily distinguished according to their cultural and religious backgrounds, offering a deep cultural richness not found in other games, and one that (being algorithmic) changes and evolves upon every new playthrough. The dialect system currently consists of a range of factors which this paper will now explore – the variation of syllables and word structures used by each nation, references drawn from geographical and natural sources, styles of name, appropriate greetings, insults, compliments and farewells, and the complexity of sentences and the numbers of clauses offered by characters in conversations. These elements are procedurally distributed to each nation at world generation, although some variants are only enabled when certain conditions are met. This means that not all components of dialect styles are equally likely to occur,

resulting in a more complex distribution of "common" and "rare" dialect styles instead of an even distribution. The paper now outlines these elements, their variation, and some different styles of offering the same information produced by varying generated dialects.

SYLLABLES

The first component of the dialect generation system is the assignation of a set of syllables, preferred consonants, and preferred vowels to each civilization. This is the only aspect of the generation system that is random, rather than procedural and influenced by many other additional factors in the generation process. The game selects a database of syllables randomly constructed from consonants and vowels, and a small number of attendant consonants and vowels, and all words or titles within that culture utilize those sets of characters. The extent to which a culture adheres "strictly" to preferred characters varies according to a number selected at random during world generation, ranging from 100% – in which case every cultural word will contain only those characters and syllables – to 70%, in which case each word will be clearly similar, but will vary more than in other cultures. This is the foundation of the creation of names of all sorts, for cities and individuals and works of art, and an important aspect for creating distinctive dialects.

REFERENCES

The second component of the dialect generation system is the creation of a database of relevant "references" for each civilization, based on the environment of their capital, and the environment of subsequent settlements and any attendant colonies. These references have several sorts. Geographical references refer to climate and terrain in these areas, and such references will be used in the names of cities and individuals; equally, references to plants, animals, and historical events will be utilized in more regular conversation as points of reference, observations, and relevant to a character's discussion of their opinions and the cultural and historical world in which they live. The ideological standpoints of cultures, and their attendant religions (if any), are also factored in, as characters will often refer in conversation to their gods or the history of their civilization. By the conclusion of world generation, each culture has a wealth of references stored that their citizens will draw upon in conversation, ranging from metaphors to literary references, and historical observations to religion-appropriate prayers.

NAME GENERATION

The third component of the dialect system is the procedural generation of a "name archetype", which is an archetype which in turn procedurally generates names for each individual within a civilization. These can combine references, syllables and characters as explored earlier, interim characters such as "-" and connecting terms equivalent to the real-world German "von", into a wide range of potential archetypes, a small portion of which are shown in Figure 3. These names form a very distinctive part of each culture – since everyone the player talks to will reflect that culture's naming style – whilst also, in the cases of names that contain references, serve to situate the culture in its geographical, historical and religious context. Some names contain references to the specific history of an individual, just as some cultural dialects allow for the emergence of idiolects, where the expressions of an individual within that culture are strongly shaped by their own history (although this is an aspect to be developed in more detail in the near future).

Figure 3: nine examples of name generation algorithms. Clockwise from top left: based upon Icelandic names; three names of decreasing length; names with geographical references; "Homeric" names; names based on geographical, animal and plant references; names from a strongly isolationist nation; names drawing on plant references; names from a civilization focused on exploration and expansion; and names with three short hyphenated sections. Each of these contains sets of syllables and references unique to that culture.

GREETINGS, FAREWELLS, INSULTS, COMPLIMENTS

The fourth component of the dialect generation system is the generation of greetings, farewells, insults, and compliments for each culture. These are essential components of in-game conversations, and given their regularity in gameplay, I sought to ensure a substantial amount of difference between cultures in this regard. These draw heavily upon the set of "references" listed above. For example, the people of a particularly zealous nation might offer "greetings from the one true god" whilst people from a nation with particular skill in mathematics and architecture might offer "greetings from the great architects who built our cities". Similarly, a nomadic nation might threaten the player by stating "may you be buried beneath the sand where none shall find you", whereas a nation whose geographical location is replete with colonies of birds of prey might state that "your body will be pecked apart until nothing remains". These are produced through the combination of a large database of hand-written variations for civilizations of certain sorts, variation within those variants according to references to geography and other elements, and in many cases integration between multiple ideologies to form statements that remain logically coherent, and hint towards more than one element of the cultural background of the individual making the statement. The conversation window as it currently stands can be seen in Figure 4 – conversations scroll up in the centre of the screen as they are uttered. Figures 5 and 6 then show two possible conversations, in which the player has asked the same questions and been given highly divergent styles of reply by the NPCs.

Figure 4: the in-progress conversation window. White text shows the standard conversation options, which expand into large menus showing conversation aspects the player is/is not able to say in the selected dialect. The blue text on the left is a special option which shows due to the NPC being a guard. On the right, dialects the player character knows how to speak in can be selected.

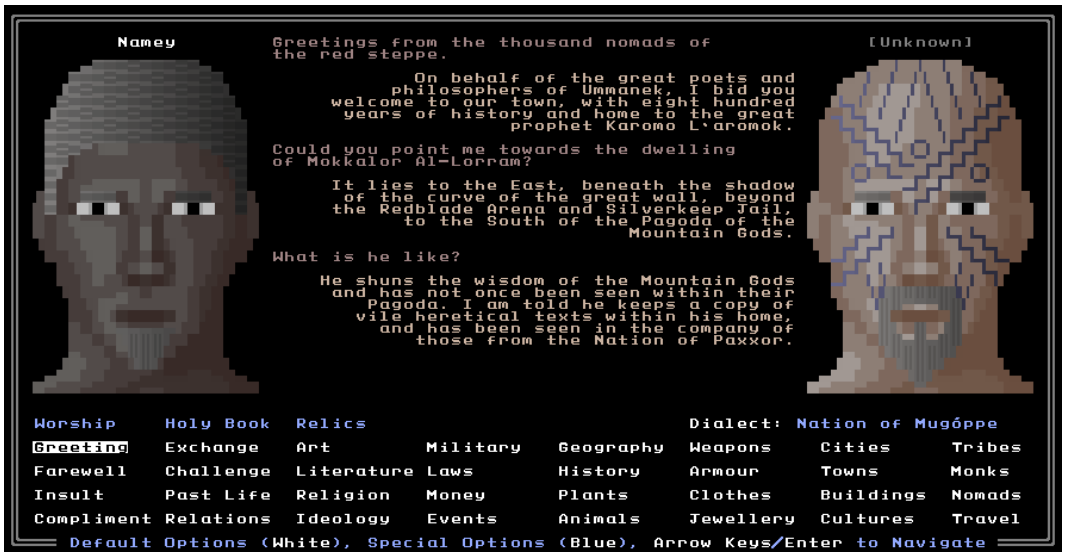

Figure 5: three sentences uttered by the player to an NPC. The NPC has responded according to their cultural/religious/historical/etc background and origin, and has given lengthy detailed replies.

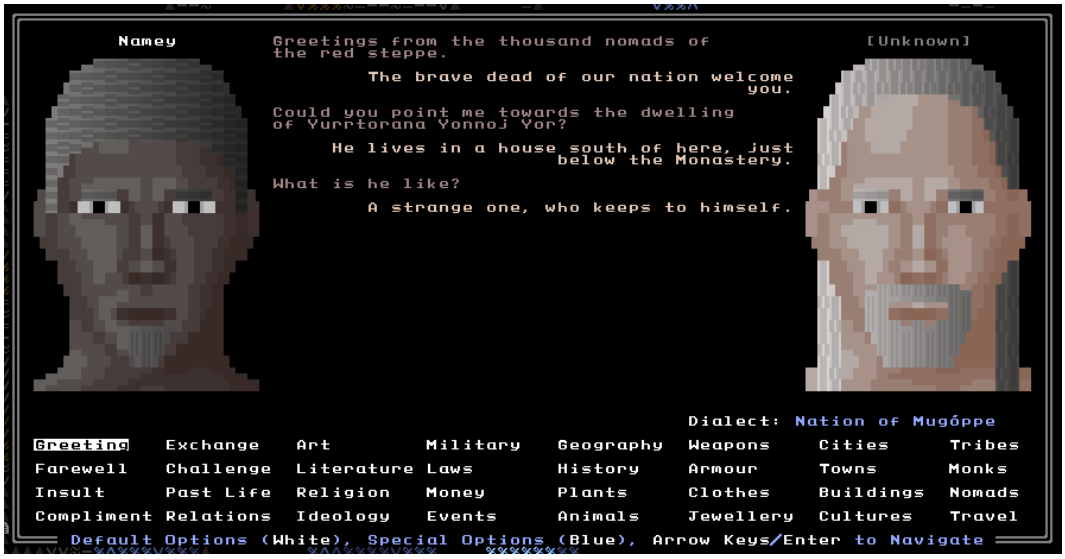

Figure 6: the same three questions asked to an NPC from a very different culture, who instead generates very short and brief responses.

SENTENCE COMPLEXITY

The fifth and final component of the dialect generation system is "sentence complexity". This refers to the amount of detail any NPC in a given culture will offer the player in the sentences uttered in conversation, and is an aspect of the dialect generation system which cuts across all the other variables outlined above. Sentence complexity varies on a scale which the game uses to determine how long each sentence should be (on average) and therefore how much information NPCs give to the player, and therefore can be seen as a measure of how taciturn or loquacious the people of each culture are. This might range from "She lives over there" to "She lives over there, by the church, beneath the mountain, with her partner, after a life of travel", and everything in-between. There is significant gameplay benefit to identifying a culture whose people are particularly descriptive when questioned, because such cultures are likely to have people who will offer the player the most information, and the game's victory and loss conditions are dependent upon the player acquiring and acting intelligently upon their acquired information. As with many aspects of other elements in roguelikes, this is a strategic element that must be balanced against others – a "wordy" culture might have highly priced items, for example, whilst a culture famed for its brevity might offer only expensive items, encouraging the player to make long-term decisions about their priorities and their subsequent movement around the world map. I therefore propose the potential for dialect generation systems to actually offer specific gameplay decisions, as well as intricate social and cultural detail. This is a field which merits greater investigation, both in *URR* as the game develops and gameplay feedback is received from the game's fan-base, and in other future games as well.

CONCLUSION

This paper has described the ongoing development of a complex dialect and speech-generation system heavily informed by in-game procedurally generated cultures, religions and social norms, and influenced by real-world literature. The system is able to create names that vary according to archetypes consistent within a culture but are strongly

divergent across cultures, as well as creating compliments, farewells, insults and greetings, and varying the complexity of a sentence and therefore the amount of information given to a player. The system can create sentences for any possible combination of cultural and religious in-game influences, resulting in dialects specifically tailored to the cultures the player meets within the game.

The author believes that such systems have substantial potential future value to the creation of rich and detailed historical interactive media (games and otherwise), which will be in stark contrast to more ordinary "historical" game spaces filled with AI actors who simply state and restate identical or similar modern-English sentences. The elements explored above combine to offer an effectively infinite number of procedurally-generated dialects. Such a system lends far greater believability to a world supposed to be rich and history and cultural variation, and actively engages the player in the process of "discovering" the world through the dialects spoken by, and expressions and terminology used by, its inhabitants. The approach explored here is not limited to worlds that are procedurally-generated: entirely static physical in-game worlds would also be substantially enhanced by the deployment of a system which ensures that characters supposed to hail from different nations, cultures, religions or backgrounds, actually speak as if they were truly from divergent sociocultural origins.

The paper has therefore explored the origins of this system, the variation within the system, and its wider potential for applicability to games and game design. The author believes the current and future development of such systems to be essential for the creation of truly believable socially and culturally rich simulation games, and for pushing the edges of procedural generation into new, more "qualitative", domains.

Keywords

Qualitative procedural generation, languages, dialects, sentences, names, literature

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