INTONATION IN CONTACT: PROSODIC TRANSFER AND INNOVATION AMONG YAMI-MANDARIN BILINGUALS

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Yami, an Austronesian language spoken on Orchid Island, Taiwan (less than 1,500 fluent speakers), is currently facing endangerment due to heavy contact with Mandarin. This dissertation investigated whether there is contact-induced prosodic variation in Yami-Mandarin bilingual speech, while also describing and documenting the evolution of Yami intonation. I advanced the description of key aspects of Yami intonation, which allowed the examination of Yami-Mandarin bilingual intonation patterns. This permitted identification of potential Mandarin influence in Yami and vice versa.

Five sentence types (statement, neutral question, confirmation-seeking question, default statement question (SQ1), and statement question conveying lighter incredulity (SQ2)) were elicited using a new paradigm – the Interactive Card Game. Three acoustic parameters were considered: final boundary tone, F_0 slope, and mean pitch height. To gauge the impact of language background, 44 participants were divided into Yami-monolingual, Yami-dominant bilingual, balanced bilingual, Mandarin-dominant bilingual, and Mandarin-monolingual groups.

Older fluent Yami speakers distinguished falling statements and neutral questions from rising confirmation-seeking questions and SQ1s, but had no authentic SQ2. Bilinguals, however, *transferred* this Mandarin question type (SQ2) into Yami. This was then intertwined with Yami intonation to form a *hybrid* pattern. For Mandarin production, ethnically Yami, linguistically Mandarin-monolinguals patterned exactly with mainland Mandarin speakers by making a three-way distinction among falling, level, and rising intonation patterns. Bilinguals only showed a two-

way distinction merging SQ1 and SQ2 into a single SQ category (a Yami substrate effect), which was then realized with a Mandarin-SQ2-like level contour to form another hybrid pattern.

The current linguistic ecological context plays a crucial role in determining the evolution of bilingual intonation. Specifically, considering the imbalanced power relationships between the groups and the socioeconomic pressures on Yami speakers, the two innovative hybrid patterns suggest an in-progress asymmetrical *convergence* of the intonation systems. This research expands the body of work on contact-induced prosodic change underscoring that higher-level prosody is permeable under contact. It also adds to studies on Austronesian/indigenous language intonation features. The broader impacts extend to heritage language education as the study has the potential to help Yami teachers develop new strategies in teaching language prosody.

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長風破浪會有時，直掛雲帆濟滄海。

〈李白．行路難〉

於立身行事、於探索真理

PREFACE

It never occurred to me that the unplanned summer trip to Orchid Island in 2008 would tremendously change my life, leading me to an exciting yet challenging adventure thereafter.

Orchid Island, home of the Yami people, was designated as an indigenous reserve for several decades but has recently rebranded itself as a summer vacation spot in Taiwan. Like most tourists, I enjoyed the stunning scenery and appreciated the oceanic cultures that are so different from mine. However, after having deep conversations with local people, I came to realize how, for a long time, the Yami people had been disregarded by mainstream Taiwanese society and how they had been deprived of basic human rights. These include speaking their mother tongue and using their native name in public spaces – things I previously took for granted but that the Yami people had been fighting hard for.

Even worse, due to the imbalanced power relationships between Taiwanese and Yami societies, younger Yami people are facing rapid language loss and are now standing at a crossroads, contemplating if they should step toward perceived modernity and prosperity and use Mandarin, or if they should remain firm in their language choice to preserve cultural-heritage in Yami. As a linguist and a part of the socially-dominant group, I chose to stand with the Yami people and to "do something". Providing timely description of Yami, a language on the brink of extinction, is certainly something I am doing to build a toolkit for advancing equity, access, and inclusion for this underrepresented group.

I began the study of Yami during my master's studies, which has now extended to my Ph.D. research projects. My research comprises two primary threads. The first concerns how language contact between Mandarin and Yami and the linguistic ecological context of Orchid

Island have driven segmental variation in Yami. The second line of my research deals with Yami prosody and intonation, with a focus on interrogative intonation and acoustic cues to prosodic boundaries. These lines of research are connected to generate the overarching inquiry of this dissertation, *Intonation in Contact: Prosodic Transfer and Innovation among Yami-Mandarin Bilinguals*. The results suggest both prosodic transfer and innovation in bilinguals' Yami production. If these novel patterns continue, present-day Yami intonation, should it survive, may evolve over time toward a new-styled system.

Completing my doctoral degree marks a significant milestone in my life. My current level of success, however, would not be possible without the assistance of many remarkable individuals who I wish to acknowledge:

First and foremost, I wish to thank my host parents Siaman Jiyakneng and Sinan Jiyakneng. Over the past ten years, they treated me as family, introduced me to other community members, and served as my language and culture consultants so I could immerse myself in a natural setting to see, listen, and taste the authentic flavor of Yami culture. Simultaneously, I want to express my thankfulness to Si Narway, Sinan Derlan, Siaman Pangpang, and Wen-Sheng for their kind assistance in participant recruitment and to all participants for providing invaluable research data. It has been a great honor and pleasure to collaborate with the community members and to apply cultivated skills and knowledge to study such a beautiful language.

I would also like to express my sincere gratitude to my mentor and advisor, Professor Shelome Gooden, who shepherded me with her sage guidance through all these years at Pitt. She helped me formulate research questions, spotted flaws in my research, gave intelligent feedback, and gave me the audacity to approach questions with innovative ideas and techniques, all of which

help me continue to grow and develop from an information-receiver to a knowledge-producer. One day, I hope to inspire someone else as she has inspired me.

Also, I would like to give a heartfelt thank you to my committee members Professor Karen E. Park, Professor Melinda Fricke, and Professor Seth Wiener, each of whom has provided words of guidance and shrewd insights through the research process. Not only has their expertise complemented this dissertation from diverse perspectives, but they have set up models for me as being good instructors, mentors, and friends.

Dozens of people have also helped me immensely along the rough road to complete my degree over the years. I acknowledge my friends Anita, Michael, Sylvia, Hans, Kuang-Hsin, Faye, Candace, Austin, James, Zhaohong, Nori, Roxanne, Hui-Shan, Pei-Yi, Elsa, Sheng-Fu, Sarah, and Jacky for always standing by my side as patient listeners and instruction-givers when I fell on hard times. I appreciate them more than words can express as their timely support has always helped me regain strength to carry on. From scholarly conversations to silly moments, the lovely memories we make together have become an integral part of my life, always and forever.

I would also like to share my work with my colleague C.-C. Lin, who passed away in his fieldtrip on Orchid Island and would never have a chance to complete his work. It is tough to put it into words the sadness of the loss of such a promising researcher. I admire and respect his unparalleled passion, courage, and perseverance for his research that shall never wither away.

Lastly, I would like to dedicate this dissertation to my dearest parents, my sister, my nephew and niece, and family members in Taiwan, who are mentioned endmostly to emphasize the special nature of their ceaseless love and support, encouragement and wish, and understanding when I was away from home.

Looking back at the path I have traveled for the past ten years, the joy, distress, laughter, and tears have left an indelible imprint on my heart. I feel grateful for having such experiences that have instilled fortitude in me and have continuously spurred me on to learn and discover, from then to now; now to the next stanza in my life journey.

Li-Fang Lai 賴莉芳

Pittsburgh, July 1st, 2018

1.0 INTRODUCTION

In an age of increasing mobility and intercommunication, group contact is unavoidable. This has often induced (reciprocal) changes in the speaker's native language. *Borrowing*, defined as the incorporation of foreign elements into the recipient language (Thomason & Kaufman, 1988: 21, 37), is amongst the most prevalent and obvious byproduct of this. Referring to intensity of contact, linguistic structures are argued to follow a borrowing hierarchy that begins with non-basic words and then followed by syntactic or phonological features. Under extremely intensive contact, fine-grained inflectional morphology or lower-level prosody[1] may be added into the recipient language (Thomason & Kaufman, 1988: 74-76; Thomason, 2001: 69-71). This may result in loss, addition, modification, or replacement of pre-existing features, a restructuring process that affects the recipient-language system (Mufwene, 2001: 16-22; Thomason, 2001: 85-88).

While these rubrics make no direct predictions for higher levels of prosody, there is a growing body of research showing that higher-level prosody is in fact permeable under contact (see chapter 2.0). Yami, an endangered Austronesian language spoken in Taiwan, has revealed signs of contact-induced segmental (Lai & Hsu, 2013; Lai & Gooden, 2014) and prosodic variation (Lai & Gooden, 2018a, 2018b) under long-standing Mandarin hegemonic language policies (1946-

[1] Lower-level prosody concerned with smaller prosodic constituents such as mora and syllable; higher-level prosody deals with larger prosodic elements such as foot, prosodic word, intonational phrases, etc. See 2.2 for more discussion on prosodic categories and structure.

1987). These studies offer crucial theoretical perspectives and have laid a key foundation to generate the overarching inquiry of the dissertation – *whether there is evidence of contact-induced prosodic change in Yami-Mandarin bilingual intonations*.

1.1 BROAD GOALS

This dissertation pursues two goals. First, to describe Yami intonation and second, to explore Yami-Mandarin bilingual intonation patterns, given Yami-Mandarin contact.

1.1.1 Why Yami intonation?

Yami is an endangered indigenous language spoken on Orchid Island, Taiwan. Due to geographic remoteness and the difficulty in recruiting fluent participants, Yami has not received much scholastic attention until recently. Despite growing interests and endeavors in documenting this vanishing language, the bulk of studies have largely centered on morpho-syntax (Ho, 1990; Chang, 2000, Rau & Dong, 2006), sociophonetic variations (Rau & Chang, 2006; Rau, Chang, & Dong, 2009; Lai & Gooden, 2016b, 2017, Accepted), and language shift toward the socially-dominant Mandarin (Li & Ho, 1988; Rau, 1995; Chen, 1998; Lin, 2007; Lai, 2011), leaving Yami intonation and prosody a severely understudied area.

Building on preliminary results on Yami prosody (Lai & Gooden, 2016a) and intonation (Lai & Gooden, 2015, 2018a, 2018b), this dissertation aims to provide a thorough description of key aspects of Yami intonation. This, in turn, may reveal some unknown yet interesting interaction between syntax, intonation, and pragmatics, another unexplored aspect of Yami linguistics.

1.1.2 Why Yami-Mandarin bilingual intonation patterns?

Contact-induced influence is seen in Yami segmental phonology ([ɮ] > [l]) (Lai & Hsu, 2013), and this change is arguably linked to the current ecological context of Yami-Mandarin contact (Lai & Gooden, 2014). Following this line of argument, the dissertation examines Yami-Mandarin bilinguals' ***Yami*** intonation to see if Mandarin has also permeated through higher-level prosodic features of Yami.

It should be noted however that, contact-induced prosodic changes are not limited to uni-directional borrowing. Bilinguals may display bi-directional (Mennen, 2004) or fused (Queen, 2001) patterns that are neither like their native (ethnic) language (L1) nor the foreign/second language (L2). Investigating Yami-Mandarin bilinguals' ***Mandarin*** intonation is thus also necessary to help unpack the richness and dynamics of bilingual intonation patterns.

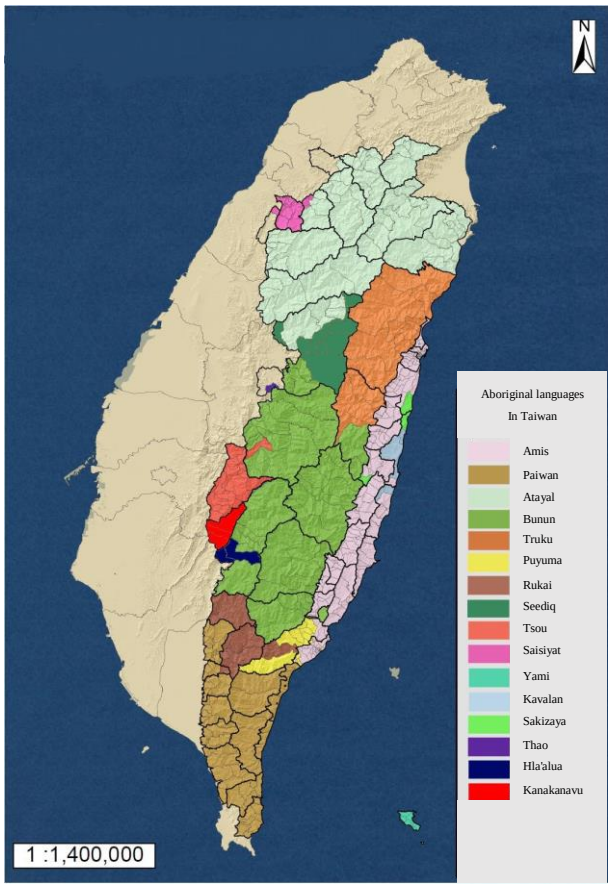
1.1.3 Intellectual merit and broader impacts

In sum, this dissertation permits an overview of Yami intonation. This sets up the starting point for documenting the evolution of Yami intonation in face of heavy contact with Mandarin speakers. More specific details are provided in Section 2.4. This dissertation is instructive on a broader scale as it offers insights to account for the sound change in other indigenous/minority languages, which are also in intense contact with socially-dominant languages. Broader impacts of the research extend to heritage language education as it has the potential to help Yami teachers develop effective strategies in teaching language prosody.

1.2 A SOCIAL PORTRAIT OF ORCHID ISLAND

1.2.1 Social portrait – From isolation to post-insularity

Taiwan is a multi-ethnolinguistic society in which Taiwanese Mandarin, Taiwanese Southern Min, Hakka, and more than ten Austronesian languages are spoken (Huang, 1993: 21). Yami is one of the indigenous Austronesian languages spoken on Orchid Island, located 56 miles off the southeast coast of Taiwan (Map 1). To date, the island is accessible only by ferry or flight, and these services are easily canceled due to severe weather conditions.



Map 1. Distribution of Austronesian languages in Taiwan

Source: the Indigenous Historical Justice and Transitional Justice Committee, Taiwan

Despite geographic isolation, the island's sociohistorical development is tightly linked with that of mainland Taiwan. Available sources suggest that the sociohistorical development of Orchid Island can be roughly divided into two major phases: the Japanese Colonization Period (1895-1945) and the Taiwanese Leadership Period (1945-present) (Tsai, 2009: 33-36; Lai, 2011).

1.2.1.1 Orchid Island in isolation

From the 1890s through the late 1960s, the island was designated as an indigenous reserve so that it virtually existed in isolation (Tsai, 2009: 102-103; Lai, 2011). During that period, despite the presence of mainlanders such as school teachers, government employees, and soldiers, strong language and cultural barriers hindered inter-group interaction on the island (Lai, 2011). Economically, islanders made a living from small-scaled, subsistence farming and/or fishing.

1.2.1.2 From openness to post-insularity

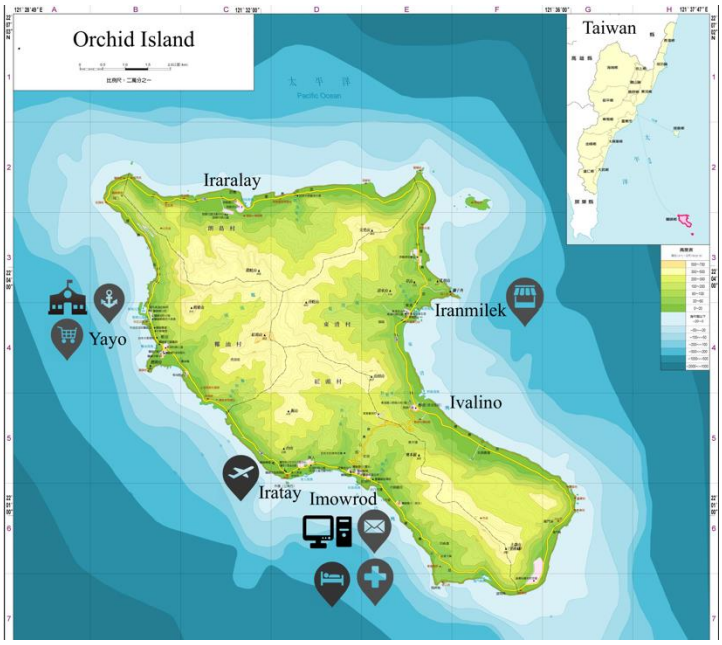
From 1967 onward, Orchid Island was opened to the public and integration into the wider Taiwan society began. This is particularly true for Imowrod, Iratay, and Yayo villages, where municipal infrastructure and facilities, such as hotels, post office, clinic, and the administrative center,[2] are located (Map 2). Consequently, these villages are considered to be more modernized and commercialized (Li & Ho, 1988; Rau, 1995; Rau *et al.*, 2009; Tsai, 2009: 33-36; Lai & Gooden, 2016b, 2017, Accepted). This commercialization also means frequent contact with Mandarin speakers, so that Yami speakers from these villages have been undergoing rapid language loss and

[2] As a part of political reorganization, the administrative center of the island shifted from Imowrod (1903-1986) to Yayo (1986-2014) then back to Imowrod (2014-present).

show a higher degree of adaptation toward Taiwanese culture (Li & Ho, 1988; Rau, 1995; Tsai, 2009: 33-36) than speakers in other villages.

In contrast, Iraralay and Ivalino villages, which are far from the commercial center, are known to preserve the Yami language and traditional housing best (Li & Ho, 1988; Rau, 1995; Chen, 1998; Lin, 2007). Anecdotally, comments from islanders suggest that Iraralay speakers are more conservative, less accepting of outsiders and preserve more traditional Yami features that make communication challenging for less proficient Yami speakers.

In the past decade or so, Iranmilek village, a place renowned for its beautiful sunrise, coastal scenery, and water sports, has become a hot spot for tourists, thus also seeing frequent contact with Mandarin speakers and subsequent erosion of Yami.



Map 2. Distribution of municipal infrastructure and facilities on Orchid Island

Source: Ministry of the Interior, Executive Yuan, Taiwan

Since the income from farming and/or fishing was low, from the late 1970s through the late 1990s, there were waves of outward migration of workers to Taiwan. Since the turn of the 21st

century, the island has gradually rebranded itself as a summer vacation spot and tourism has rapidly become the major source of income for most islanders (Figure 1).[3]

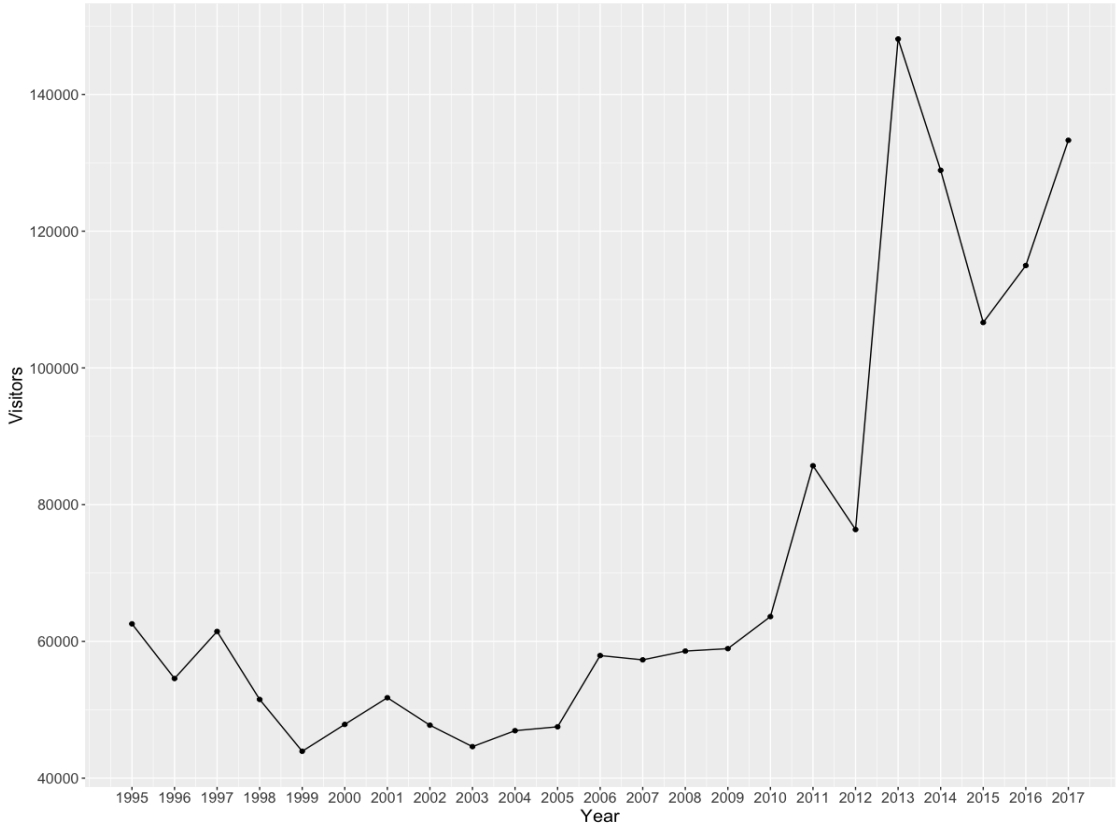


Figure 1. Orchid Island visitor statistics by year since 1995

Source: Yearly Statistics, Tourism Bureau, Taiwan

The tourism explosion has not only slowed the outmigration of young Yami adults, but has motivated other Yamis to resettle on the island. Meanwhile, it has also brought an influx of mainlanders to work and live on the island, which has noticeably shifted the demographics of

[3] The yearly visitor statistics is heavily influenced by severe weather conditions during the summer months. According to the Typhoon Database, Taiwan was hit by an average of 3.7 typhoons per year. In 2012, however, Taiwan was hit by 7 typhoons. This could potentially explain why the figure drops in 2012. In addition to weather conditions, significant cultural event may also affect the statistics. For instance, in 2013, there was a grand boat-launching ceremony held in Iranmilek village. Since traditional wooden fishing boats have largely been replaced by motor boats in present-day Yami society, the boat-launching ceremony presented a unique opportunity for the tourists to witness and experience authentic Yami culture. This may explain why the figure boosts in 2013. Even though the yearly statistics fluctuates, it reveals a trend that the number of travelers increases steadily since 2000.

Orchid Island. The 2016 Taiwanese census reveals that the proportion of non-Yami people has nearly tripled in less than twenty years, which now represents 19% of the local population.

1.2.2 Language contact and sociolinguistic effects

1.2.2.1 Japanese influence on Yami

During the Japanese Colonization Period (1895-1945), Japanese was imported to Orchid Island through a compulsory education system beginning in 1923.[4] Yami seniors recalled that in addition to using Japanese as the medium of instruction, the teachers also asked students to speak Japanese in school. Even so, they still spoke Yami during the break time and they were never punished as the teachers found them violating the policy. Because of this, students did not perceive any power differential between Japanese and Yami (Lai, 2011).

During that time, the Yami-Japanese bilinguals were limited to school children. Considering the fact that the use of Japanese was confined to the school settings and that school attendance was low,[5] the linguistic impact of Japanese on Yami is presumed to be inconsequential, and is chiefly reflected in the borrowing of non-basic vocabulary (Lai, 2011). Today, Japanese is only sporadically used by a few older (over 80) Yami speakers.

[4] The second elementary school was established in Iranmilek village in 1939.

[5] Even though the proportion of school children to total Yami population increased steadily from 1.9% in 1929 to 17.5% in 1943, the figure (17.5%) was still well below the average of other indigenous people (52.9%) in Taiwan in 1943. Sources: Suzuki (1932: 358, 366); Police Affairs Bureau, Taiwan Governor-General (1944: 33, 48f).

1.2.2.2 Mandarin influence on Yami

In stark contrast, Mandarin has exerted profound pressure on Yami. As the Japanese Colonization Period came to a close in 1945, the Taiwanese government introduced Mandarin into Orchid Island via education system and simultaneously banned Yami from schools, thereby creating fertile ground for Yami-Mandarin contact. The education system, together with *the Mandarin Movement* (1946-1987) – a monolingual hegemony that strongly devalued and prohibited the use of other Taiwanese ethnic languages in public spaces – quickly established community-wide Yami-Mandarin bilingualism.[6]

Decades of Mandarin-only policy has tremendously threatened the diversity and vitality of other ethnic languages, and has thus yielded generations whose Mandarin fluency outstrips their mother tongue proficiency in all parts of Taiwan (Wei, 2006). Today, Yami children and teenagers (except those who are from Iraralay) virtually do not speak their heritage language other than in schools.[7]

The current tourism boom has further withered away Yami vitality because Mandarin is the medium of inter-ethnic communication and is considered the key to economic success. Locals generally agree that only those who are over 50 years old (approximately 1,500 speakers who comprise 29% of total population) can still handle Yami with comfort and confidence. The latest fieldwork survey (Lai, 2017) reveals that currently, there are only a few domains like rituals and religious settings that resist major influence from Mandarin. If language loss continues, not only

[6] An earlier survey (Lai, 2011) shows that the Yami people had different thoughts on this. Some disagreed with this policy and challenged "What's wrong with speaking my own language?"; others took a more positive position as they believed that Mandarin would be a necessity of modern life and could provide them with a tool to connect with the outside world.

7 Yami has been offered as a mandatory course on a two-hour-per week basis on Orchid Island since 2001 to promote language revitalization.

will it erode Yami-Mandarin bilingualism, but it may ultimately lead to a near elimination of Yami by future generations (Crystal, 2000: 19-21). The sociohistorical development and language contact situations of Orchid Island are summarized in Table 1.

Table 1. Socioeconomic transformation and sociolinguistic facts of Orchid Island

Year	1895	1923	1945	1967	1987	2000	present
Historical phases	Japanese Colonization Period			The Period under Taiwanese Leadership			
Social isolation	Indigenous protected area			Open to public, connection with the outside world			
Source of income	Fishing and/or farming			Sought jobs in Taiwan > Tourism trades			
Language contact • Medium(s) - Sociolinguistic effects	Yami-monolingualism	Japanese • Education - Lexical borrowing		Mandarin • Education + the Mandarin Movement + booming tourism - Community-wide Yami-Mandarin bilingualism → language shift → elimination of Yami in the future? - Contact-induced change in Yami phonological system			

Note: Green and blue shades were used to indicate transitions in historical phase, social isolation, source of income, and language contact and its effects on Yami.

1.2.3 Inter-group conflicts between Yami and Taiwan societies

It merits mentioning that other than language oppression, some highly controversial national policies have further provoked conflicts between native Yami people and the wider Taiwan society.

1.2.3.1 Sociopolitical conflicts between the Taiwanese government and the Yami community

The Indigenous House Modernization Project (1966-1979) is one instance out of many conflicts. During that period, locals were forced to demolish their traditional houses with their own hands and to replace them with concrete block houses. The Yami people deemed this act an affront to

their culture, but from the government's perspective, it was an emblem of advancement and modernization for these aboriginal people.

An even more notorious example is *The Orchid Island Project* (1975-1996), a governmental deception that turned a fish cannery into a nuclear waste repository. The following excerpts of conversation from my fieldwork (Lai, 2014, 2015, 2017) show that the Yami people were excluded from the decision-making process:

(1) [Male, 83 years old, Ivalino]: *In the 1970s, the government officials and experts conducted field investigations here, claiming that what would be built was a fish cannery to offer job opportunities for the locals. Since the income from farming or fishing was low and economic opportunity was severely limited on the island, we would be glad to take advantage of this opportunity to work in the fish cannery. This way we could lead a stable life here and don't need to be "uprooted" from our homeland to work in Taiwan. However, after months of waiting, the canned factory turned out to be a nuclear waste dumping site. Since then, we have been forced to live with "the unwanted Taiwanese litter" and to live with fear and anxiety everyday.*

In 2017, the Indigenous Historical Justice and Transitional Justice Committee of Taiwan disclosed a government record which shows that in 1975, Orchid Island was selected as a nuclear waste repository (square A in Figure 2), and that the record was declared by law to be confidential (square B in Figure 2).

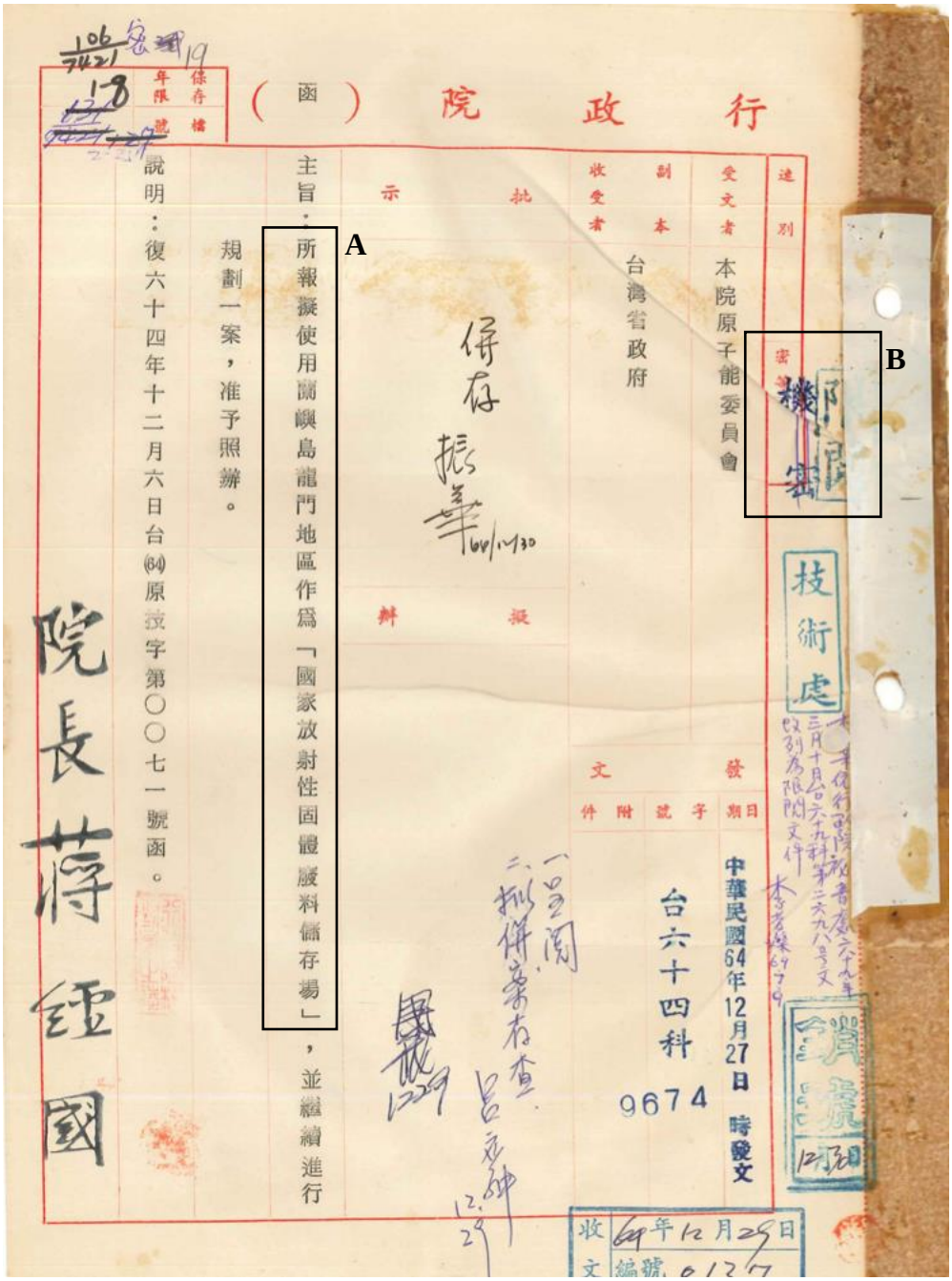


Figure 2. Document outlining the decision-making of selecting Orchid Island as a nuclear waste repository in 1975

Source: the Indigenous Historical Justice and Transitional Justice Committee, Taiwan

Even though the Taiwanese government had pledged to relocate the radioactive waste by 2002, its failure to keep its promise has deepened the Yami's mistrust toward the government (Fan,

2006). The Yami anti-nuclear waste movements go on and the islanders' outrage continue to grow, as expressed in (2):

(2) [Male, 63 years old, Iranmilek]: *Our land, food, and ocean are poisoned; more and more people die from unknown diseases. If the island is a boat, the boat is about to sink. Please save us from danger and fears. Please return our land to us.*

The pursuit of indigenous autonomy. The abovementioned national policies are clear manifestations of injustice, lack of recognition, and the exclusion of Yami people from decision-making processes. Many locals experienced "a sense of bullying of the ethnic minority" and described themselves as "people of trifling importance" (Fan, 2006).

Considering the long-term asymmetrical power relationships between Taiwan (dominant, central) and Yami (subordinate, marginal) societies and global awareness of the need to protect and enhance indigenous peoples' rights, Yami activists released the *Yami Autonomy Declaration* in 2000 to pursue self-determination in tribal political, economic, sociocultural, and territorial issues (Lu, 2002; Fan, 2006). A recent fieldwork survey (Lai, 2017) provides compelling evidence for this. When asked *"What culture(s) do you identify yourself with?"*, the majority of the participants identified themselves as Yami. Only 6 out of the 44 participants declared both Yami and Taiwanese identities.

1.2.3.2 Tourism as a double-edged sword? Sociocultural clashes with tourists

With ever increasing reliance on the tourism economies, there are also spreading sociocultural conflicts between locals and the tourists. For instance, the tourists may violate cultural norms,

damage and pollute the (coastal) environments, or even invade local people's house. Consequently, some islanders are becoming hostile towards the tourists and see them as "intruders".

Additionally, although the tourism industry has presented business opportunities for the Yami people, it has also attracted more and more mainlanders to work and live on the island. This further annoys locals, even those who reside in areas where they have frequent contact with outsiders (see (3)):

(3) [Male, 56 years old, Iratay]: *The mainlanders don't belong to here; they don't understand our history and culture, but they come here, working as tour guides or pretending to be Yami experts to "get a slice of the pie".*

Including metalinguistic comments is important to this dissertation because they suggest the current sociopolitical climate of Orchid Island and reveal the islanders' psychological status, both of which are considered essential parts of language ecology (Haugen, 1972: 325; Mufwene, 2001: 15-19). Language ecology thus plays a decisive role in shaping language behaviors and has the potential to indicate path for the evolution of Yami and Mandarin intonations in Orchid Islanders' speech.

1.3 DISSERTATION OUTLINE

The dissertation is organized as follows. The present chapter specifies the overall research goals and provides a panoramic view of the sociohistorical fabric and language ecology of Orchid Island over the past hundred years. Chapter 2.0 consists of four major sections. First, I discussed speaker typology and language loss in endangered language communities. Second, I reviewed the literature

on contact-induced prosodic change in various contact situations. Third, I outlined the key theoretical assumptions regarding prosody and intonation that are adopted for the analysis of Yami. I also made a cross-linguistic comparison between Mandarin and Yami intonations to see how the two systems function similar to or distinct from each other. Last is the formulation of the research questions. Chapter 3.0 offers details on participant recruitment and classification, introduces task design and corpus collection, and describes data analysis plans. Next, the results on bilingual intonation patterns are split into Chapter 4.0 (Yami results) and Chapter 5.0 (Mandarin results) respectively. Chapter 6.0 explores how bilinguals' language background and linguistic experience impact their intonation patterns. In Chapter 7.0 , I revisited the research questions and recapped major research findings, discussed the significance and contributions of the dissertation, acknowledged limitations of the current study, and suggested directions for future research. In the EPILOGUE , I summarized the linguistic ecological contexts across contact situations and proposed a provisional framework accounting for the effects of language ecology on prosodic change in cross-linguistic settings.

2.0 LITERATURE REVIEW

This chapter contains four parts. First, I describe speaker typology and introduce theoretical models accounting for language loss in dying language communities. Second, I provide a comprehensive review of prosodic change in diverse contact situations. Next is a cross-linguistic comparison between Mandarin and Yami intonations to identify areas for potential contact effects of Mandarin on Yami, and vice versa. Last, I describe in more detail the research objectives of the dissertation.

2.1 VARIATION AND CHANGE IN DYING LANGUAGE

2.1.1 Speaker typology in endangered language communities

Speakers in indigenous societies do not always fit neatly into categories between gender or social class frequently assumed in urban settings (Clarke, 2009: 109-128; Romero, 2009: 281-297; Stanford & Preston, 2009: 1-20). Conventionally, speakers in endangered language communities have mainly been classified by their language proficiency as full speakers, semi-speakers, and terminal speakers (Dorian, 1981, 1994a; Sasse, 1992a; Grinevald, 2003). Each type of speaker differs in their language dominance and proficiency, order of language acquisition, and language usage.

(a) **Full speakers** have been labeled as older and younger fluent speakers. Older fluent speakers have been raised mostly in their ethnic language alone, and the way they speak is considered a traditional form of the language. Younger fluent speakers refer to bilinguals who acquired the ethnic language as their first language and still show full competence in

it during adulthood. Although they may introduce, due to their bilingualism, changes in their ethnic language, the older fluent speakers would still consider them as good speakers.

(b) **Semi-speakers** refer to a large category of speakers who still possess appropriate receptive competence but show varying degrees of productive skills. They do not use their ethnic language regularly, and may too introduce changes in their speech. Yet, these changes are not accepted by the older fluent speakers. This type of speaker emblematizes situations of threatened languages.

(c) **Terminal speakers** refer to the last-generation speakers of dying languages. They may know some words or phrases of their ethnic language as a result of a very partial acquisition. Although they have virtually shifted toward the socially dominant language, they may still be recognized as members of the language community, as opposed to outsiders who simply learned elements of the language.

The main characterization for each type of speaker is summarized in Table 2. Note that the boundaries between younger fluent speaker and semi-speaker and between semi-speaker and terminal speaker can be fuzzy and hard to define, indicated by dotted lines between these categories.

Table 2. Speaker classification in dying languages

	Full speaker		Semi-speaker	Terminal speaker
	Older fluent speaker	Younger fluent speaker		
Language acquisition	Learned E first	Learned E first	Learned SD first Learn E by chance	
Language dominance & Proficiency	Monolingual in E	Varying degrees of bilingualism Still show full competence in E	Monolingual in SD Can barely speak E	
Language usage	Regular use of E Traditional form of E	Regular use of E Introduce changes in E	Language shift toward SD	

Abbreviations: E = ethnic language; SD = socially-dominant language

2.1.2 Loss of linguistic features in dying speech communities: Alternative models

When dealing with loss of linguistic features, different theoretical possibilities – contact-induced change (Maher, 1991: 68-82) and language decay (Sasse, 1992b: 59-80) – are proposed.[8] As discussed below, both models display similarities but also differ fundamentally in many respects. It is thus necessary to carefully set the two frameworks apart in dying language communities.

2.1.2.1 Contact-induced change

According to Maher (1991), the locus of contact-induced change is the bilingual individuals. These bilinguals acquire their ethnic language (typically the minority or the less prestigious language, denoted as language A) first via normal intergenerational language transmission. The A speakers gradually accumulate language knowledge and successively arrange it in their native language system. However, when A speakers are surrounded by speakers of a dominant language (denoted as language B), they may over time develop good language command in B and become A-B bilinguals. However, this often induces reduced morphological and syntactic structures in bilinguals' A production. The key characteristics include:

(a) Reduction in the number of allomorphs (i.e., more invariable forms);

(b) Replacement of synthetic forms by analytic ones;

(c) Progressive reduction in inflectional morphology, entailing less flexible word order;

(d) Preference for coordinate rather than embedded constructions, etc.

[8] While the two models primarily focused on the reduction and simplification of morpho-syntactic features, the results, I believe, have implications for prosodic variation and change as well.

It should be noted that although some complex aspects of A are lost in bilingual speech, several more are still retained and are consistent with conservative norms produced by older monolinguals. Maher (1991) described this process as an elimination of opaque constructions in favor of greater morpho-syntactic transparency to make communication more efficient and less ambiguous. Maher considered this a restructuring or reconfiguration of morphological and syntactic structures among bilinguals (see also Haugen (1978)). It should be noted that, the process of reducing grammar complexity exhibits a certain degree of stability so that the morpho-syntactic structures are still comprehensible and are fully functional in conversation.

2.1.2.2 Language decay

The locus of language decay, on the other hand, is semi-speakers, termed by Sasse (1992b) as "the producer of the distorted, pathological speech forms". As is the case of contact-induced loss, these semi-speakers form a minority group surrounded by other socially-dominant groups. However, this group of speakers has not learned their L1 by way of a normal language acquisition process. Rather, they learn the language just by listening to and occasionally talking to elder fluent speakers. Therefore, semi-speakers never establish a complete L1 linguistic system and are unable to utter a naturally-occurring, long conversation. Typical symptoms of semi-speaker speech include:

(a) Loss of subordinate mechanisms;

(b) Agrammatism in spontaneous speech (e.g., the entire system of tense/aspect/mood categories is becoming mixed-up, syntactic rules are not observed, etc.);

(c) Word retrieval problem and frequent code-switching;

(d) Extreme variability and inconsistency in structural features, etc.

Such “pathological and distorted speech” encapsulates an irreversible loss of language skills, a process on the path to language death (Sasse, 1992b).

To conclude, although contact-induced loss and language decay occur in similar sociolinguistic circumstances and both involve loss of linguistic material, they differ fundamentally in terms of the locus of change, language acquisition process, working hypothesis, and speakers’ linguistic output, as summarized in Table 3.

Table 3. Comparison between contact-induced change and language decay models

	Contact-induced change	Language decay
Locus of change	Bilinguals	Semi-speakers
Language acquisition process	Normal intergenerational transmission	Random acquisition
Language skills	Speakers possess grammar proficiency and show creativity in spontaneous speech	Speakers show very limited linguistic competence confined to a small stock of phrases, clauses, and isolated word forms that prevent them from fluent communication
Working hypothesis	Restructuring of the speaker’s old language system to promote communicative efficiency	Incomplete acquisition that leads to irreversible loss of language skills
Linguistic output	Exhibits a certain degree of stability and conforms to minimal discourse requirements of a language	Begins to show pathological phenomena such as drastic agrammatism, syntactic reduction, and extreme variability that violate the minimal functional requirements of discourse

I do not assume a priori that prosodic changes in Yami are due to language contact, but compelling reasons to do so are threefold. First, the majority of the participants reported Yami as their L1, which remained their primary language at preschool age (see Section 3.1). Second, years of fieldwork experience reveals that, while the participants vary widely in their Yami proficiency, even Mandarin-dominant bilinguals (under 40 years old) are still able to produce utterances that are judged as grammatical by mid-aged and older fluent speakers. Third, I have observed instances

where fluent Yami speakers produced prosodic patterns deviant from canonical Yami intonation. Such variation is hard to explain solely through a Sasse-type language decay model (i.e., inadequate language knowledge), given speakers' grammatical proficiency.

Following this reasoning, the dissertation couches prosodic variation among Yami-Mandarin bilinguals mainly under the contact-induced change framework, the focus of Section 2.2. Meanwhile, I am open to other theoretical possibilities. Approaches such as language decay will also be adopted to facilitate interpretation as necessary.

2.2 CONTACT-INDUCED PROSODIC CHANGE IN DIFFERENT SCENARIOS

Despite fruitful research contribution on morpho-syntactic and phonological (segmental level) variation in various contact situations, in-depth discussions on prosodic aspects of language contact have a far more recent history in the literature. The section synthesizes the outcomes of prosodic contact in different scenarios, including speakers in multilingual communities, the co-existence of distinct systems in bilingual individuals, and the contact between typologically different prosodic systems.

Before proceeding to the prosodic phenomena in different contact situations, I offer some necessary background to facilitate a better understanding of different types of prosodic variation.

2.2.1 Background

2.2.1.1 Terminology

Intonation is the pitch pattern of an utterance (Ladd, 2008: 9). Speakers use pitch variation contrastively to distinguish sentence types (e.g., statements have falling contours vs. yes/no questions have rising contours), encode the information structure of the sentence (e.g., speakers produced larger pitch movement as a signal for emphasis), and express their attitudes and emotions (Gussenhoven, 2004: 50).

Pitch accent: according to the Autosegmental-Metrical Theory (Pierrehumbert, 1980), pitch accents are local intonational features that are associated with particular syllables. Different languages specify different relationships between pitch accent and stress alignment (Beckman, 1986). In English and Swedish, pitch accents are associated with stressed syllables, while in French and Indonesian, pitch accents may be associated with syllables that are not phonologically stressed (Ladd, 2008: 60).

Pitch accents consist of different pitch contours, such as a high (H) or low (L) tone target or a combination of H and L targets. In languages where pitch accents are associated with stressed syllables, one F_0 target within each pitch accent is designated with a * to indicate that this target is aligned with the stressed syllable. Figure 3 displays a schematization of six basic pitch accent types. For example, in the H+L* pitch accent, the L target is aligned with the stressed syllable and is preceded by a H target (Figure 3a). In contrast, in the H*+L pitch accent, the H target is aligned with the stressed syllable and is followed by a L target (Figure 3b).

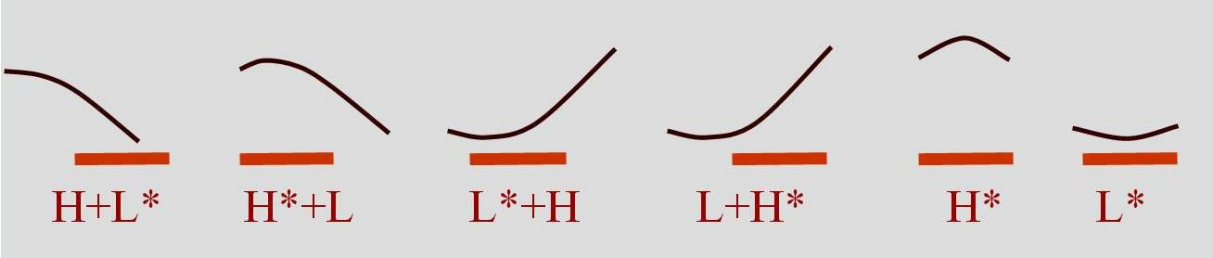


Figure 3. Schematic F_0 contours for pitch accents (Thick lines _ indicate the stressed syllable)

Source (Mata, Moniz, Batista, & Hirschberg, 2014)

Peak alignment is the timing of tone target (e.g., F_0 maxima or minima) in relation to the stressed syllable nucleus. When the tone target is realized before the onset of the stressed syllable, it is called early alignment. Whereas when the tone target is realized after the offset of the stressed syllable, it is called late alignment.

Nuclear and prenuclear pitch accent: a sentence may contain several pitch accents. Pitch accents can be divided into nuclear and prenuclear pitch accents. The nuclear pitch accent is the most important accent in the phrase and is perceived as the most prominent. In English, nuclear pitch accents occur near the end of an intonation phrase (i.e., in sentence-final positions). Pitch accents occurring before the nuclear one are called prenuclear (non-final) pitch accents.

2.2.1.2 Prosodic hierarchy

According to the mainstream theory of prosodic structure (Selkirk, 1986; Nespor & Vogel, 1986; Beckman & Pierrehumbert 1986; Pierrehumbert & Beckman 1988), prosodic hierarchy is organized as nested structure, which begins with the smallest unit mora (μ) to syllable (σ), foot (Ft), prosodic word (ω), phonological phrase (PhP) or intermediate phrase (ip), intonation phrase (IP), and the largest unit utterance (Utt). Lower-level prosody concerned with the representation

and behavior of smaller prosodic constituents such as mora and syllable, while higher-level prosody deals with the representation and behavior of larger prosodic elements from foot and above, as illustrated in Figure 4.

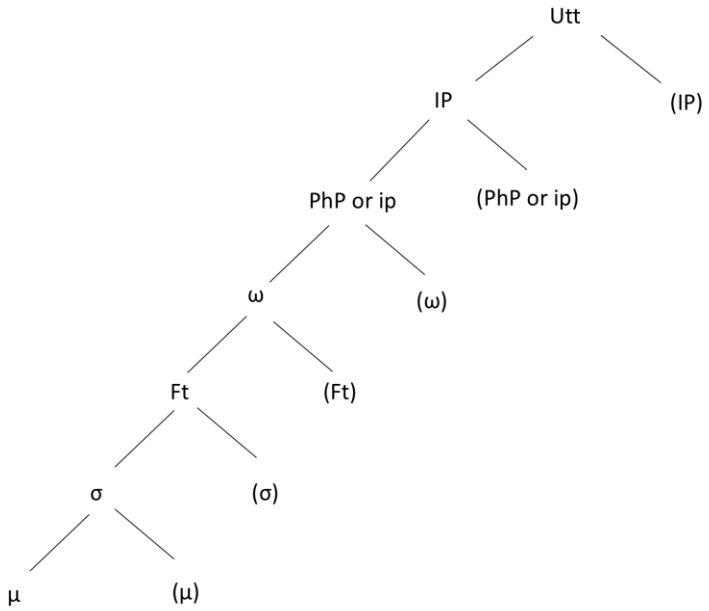


Figure 4. Schematic prosodic hierarchy

Prosody shares similarities with syntax. For instance, in both syntax and prosody, higher-level categories dominate lower ones. Additionally, speakers divide an utterance into phrases. Often, prosodic boundaries are projected from syntactic domains. For instance, a minor syntactic phrase roughly corresponds to an ip,[9] and a major phrase usually equates an IP.[10]

Beckman and Hirschberg's (1994) tones and break indices (ToBI) system is used as a typical guide for labeling intonation and prosody. The ToBI system assumes four parallel tiers of phonological information: a tone tier, an orthographic tier, a break-index tier, and a

[9] Prosodic structure is highly language-specific. The ip level is not shared by all languages. Other languages may use other prosodic categories at the ip level. For instance, French and Korean speakers use accentual phrases (APs) and tone language speakers use tone groups (TGs) instead.

[10] Even so, it is important to note that syntactic boundaries do ***not*** always coincide with prosodic ones.

miscellaneous tier. Transcriptions in this dissertation focus on the tone tier. Conventionally, we use contrastive H vs. L tone to label pitch accent (default H* and L*) associated with specific prosodic words, as well as two levels of edge tones – phrasal tones (default H- and L-) at the margins of each ip and final boundary tones (default H% and L%) at the end of every full IP, as depicted in Figure 5.[11]

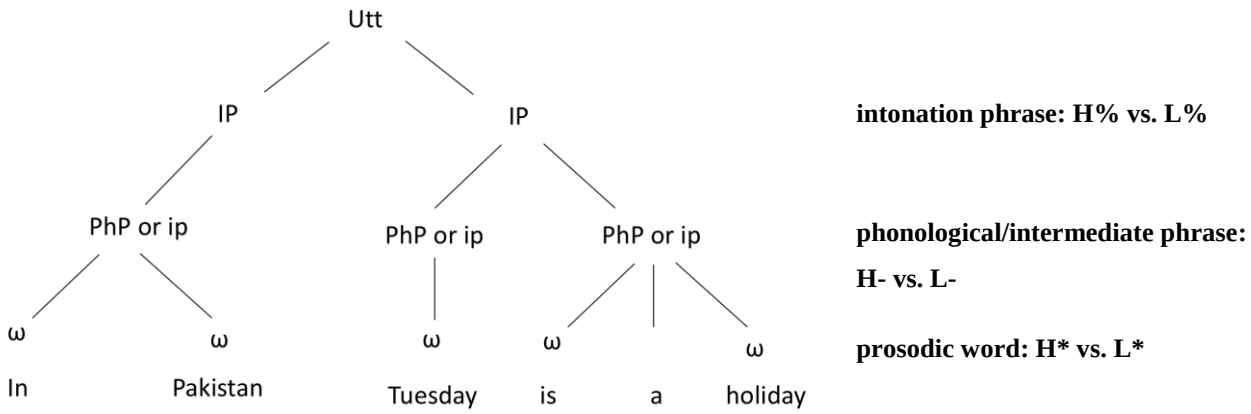


Figure 5. Tonal labeling (example from Tokizaki, 2002)

2.2.2 Language contact and prosodic transfer in multilingual communities

Although in most cases, speakers tend to show L1-to-L2 transfer,[12] more recent studies have shown transfer of melodic patterns from L2 to L1.

[11] ip and IP are associated with different degrees of juncture or boundary strength (IP > ip) (Beckman, Hirschberg, & Shattuck-Hufnagel, 2006).

[12] Prosodic transfer does not presume directionality, either L1-to-L2 or L2-to-L1 is possible. Yet, prosodic borrowing/adoption/accommodation represents the incorporation of foreign/L2 prosodic features into one's native language.

2.2.2.1 Italian influences on Buenos Aires Spanish

Colantoni & Gurlekian (2004) reported a convergence between Buenos Aires (BA) Spanish and Italian intonation under increasing influence from Italian. Contemporary BA Spanish resembles Italian broad focus statements in two aspects: early peak alignment of pre-nuclear pitch accents and steep final lowering. This deviates from earlier BA Spanish (Vidal de Battini, 1964) and other Peninsular varieties, which have late peak alignments and a shallow falling pattern respectively (for example, Tomás, 1948; Canellada & Madsen, 1987).

Colantoni & Gurlekian ascribed these BA Spanish innovations to a combination of direct and indirect transfer from Italian. Direct transfer – Spanish monolinguals adopted Italian features owing to high concentration of Italian immigrants in the city. Indirect transfer – Italian prosodic patterns have been carried over to BA Spanish through Lunfardo, a non-standard variety of BA Spanish. They argued that due to close contact between Lunfardo speakers and Italian immigrants, Italian prosodic patterns have quickly spread to Lunfardo. Recently, pop music and theater have greatly promoted the diffusion of Lunfardo, rendering it a new variety that is gaining prestige among standard BA Spanish speakers. The Italian prosodic features then spread further to BA Spanish monolinguals.

2.2.2.2 Influences of L2 Majorcan Spanish on L1 Peninsular Spanish

Similarly, monolingual Peninsular Spanish speakers showed accommodation toward Majorcan Catalan intonation, arguably due to indirect transfer (Romera & Elordieta, 2013). The two languages differ strikingly in the terminal tune in absolute interrogatives: a rising contour (L* H%)

in Peninsular Spanish and a steep falling configuration (H+L* L%) in Majorcan Catalan, respectively.

The presence of a Catalan-like falling pattern in the speech of L1 Peninsular Spanish monolinguals is deemed a product of interaction with L1Catalan-L2Spanish bilinguals. To illustrate, as monolingual Spanish mainlanders move to Majorca, L1Catalan-L2Spanish bilinguals use their L2 – an intermediary variety of Spanish that carries heavy L1Catalan prosodic features – to achieve intergroup interaction. Salient prosodic differences have then been picked up by L1 Peninsular Spanish speakers to alter their intonation. Interestingly, the adoption of prosodic features can take place in early stages of contact.

2.2.3 Co-existence of distinct systems – Bilingual individuals

Contact literature as early as Weinreich (1968 [1953]: 71) recognized bilingualism as "the true locus of language contact". According to Weinreich, from the point of view of the individual, the two languages are two types of activity in which the same organs are employed. Bilinguals may display effectively separated use of the two languages or show substratum interference of the languages with one another.

Continued efforts have been made to unfold bilingual language performance further. Recent studies have shown that keeping separate systems is less common in bilingual contexts. Rather, bilinguals are more likely to show (bi-directional) shift-induced interference or to display fused patterns that suggest the concurrence of keeping separate systems while still introducing shift-induced interference to one another.

2.2.3.1 Dutch-Greek bilinguals

L1Dutch-L2Greek bilinguals show bi-directional transfer (Mennen, 2004). Modern Greek and Dutch have pre-nuclear rises (LH*) in declaratives but differ in alignment in two respects. First, Dutch has early peak alignment whereas Greek has late alignment. Second, in Dutch, the timing of accentual peak alignment was influenced by the length of the vowel (i.e., long vowel = early alignment; short vowel = late alignment), whereas no such timing difference exists in Greek. (Ethnically Dutch) bilingual speakers showed a clear L1-to-L2 transfer (early alignment) in their Greek data. Simultaneously, they also transferred Greek-like accentual peak alignment pattern to their Dutch speech. Although bilingual speakers displayed a peak alignment difference based on vowel length, the timing difference was smaller than that produced by Dutch monolinguals. Mennen suggested this bi-directional transfer may over time lead to a divergence in bilingual intonation patterns, with the system becoming neither like Dutch nor Greek L1 patterns.

2.2.3.2 Turkish-German bilinguals

Queen's (2001) research on intonation in (ethnically Turkish) Turkish-German bilinguals is instructive. Phrase-final rises in interrogatives in Turkish have a sharp rise (L% H%) and a dipped rise (L*+H H%) in German. Two patterns were reported. First (minor pattern), bilinguals maintained separate intonation patterns in speaking Turkish and German, respectively. The second (majority) pattern showed co-occurrence of the two rises in both languages. This mixed pattern did not occur in the speech of German- or Turkish-monolinguals and is not explainable through borrowing (L2-to-L1 transfer) or interference-based (L1-to-L2 transfer) models of contact

(Thomason & Kaufman, 1988: 37-45). Queen proposed a new mechanism *"fusion"* to capture the distinct prosodic pattern.

2.2.3.3 Quechua-Cuzco Spanish bilinguals

L1Quechua-L2Spanish bilinguals in Cuzco, Peru, displayed heterogeneous patterns in their Spanish speech (O'Rourke, 2005). The two languages differ in pre-nuclear peak alignment in neutral declaratives (early alignment in Quechua vs. late alignment in Peninsular Spanish). Bilingual speakers maintained typical features in Quechua (L1) tokens. For the Spanish (L2) production, speakers spread across different alignment patterns encompassing Spanish-like late alignment, Quechua-like early alignment, and intermediate alignment patterns. The Quechua-like early alignment has also diffused through the speech of Cuzco Spanish monolinguals, making their intonation deviate from that of Lima Spanish monolinguals (late alignment) who have little contact with Quechua.

2.2.3.4 Catalan-Spanish bilinguals

Catalan-Spanish bilinguals in Majorca (L1Catalan-L2Spanish vs. L1Spanish-L2Catalan bilinguals) employed different prosodic transfer strategies in nuclear pitch accents and terminal tunes in their L2 production (Simonet, 2008, 2010). Two prosodic differences exist between the two languages. First, Catalan has a falling (H+L*) and Peninsular Spanish has a rising (L+H*) tonal configuration in nuclear pitch accent in broad focus declaratives. Second, Catalan has a falling terminal tune (H+L* L%), whereas Peninsular Spanish has a rising pattern (L* H%) in absolute interrogatives.

Participants showed canonical features in their own L1 data. The only exception emerged from younger L1Spanish speakers who shifted to Catalan-like patterns in their L1. In their L2 production, L1Catalan speakers opted to transfer L1 features to Spanish (L1-to-L2 transfer), whereas younger

L1Spanish speakers favored Catalan features (L2 borrowing). This indicates an asymmetrical convergence of the intonation systems (from Spanish to Catalan) in younger L1Spanish bilinguals' speech.

2.2.4 Contact between distinct prosodic typologies

Even less known is the outcome of contact between different prosodic typologies. From documented cases, we see that speakers tend to produce hybrid patterns in such situations.

2.2.4.1 Contact between tone and stress languages in western China

Li (1983) investigated the linguistic situation in Qinghai and Gansu provinces of China, an area where different ethnic groups, languages, and cultures meet, and found cases of prosodic borrowing between tone and non-tone languages. Due to forced Tibetanization, the Wutun Mandarin (tone language, Qinghai province) speakers have assimilated to the surrounding Tibetan language (stress language) and even consider themselves a subgroup of Tibetan ethnicity. A striking feature of present-day Wutun Mandarin is that, while the basic vocabulary and grammatical morphemes are of Sinitic origin, it does not have lexical tones. A recent study (Sandman, 2012) shows that, heavy influence from Amdo Tibetan has rendered Wutun Mandarin unintelligible to other Mandarin speakers.

Li (1983) also noted that in Gansu province, frequent contact between Hui (Chinese tone language) and the Bonan people (Mongolian stress-pitch accent language) has reduced the tone system to only three phonemic tones – the least among the tonal Chinese dialects. Interestingly,

Gansu Bonan has also taken on some tonal features from Hui and could possibly evolve into a new hybrid prosodic system distinguishing it from other dialects of Bonan.

2.2.4.2 Contact between tone and stress languages in Caribbean creoles

In some Caribbean creole languages like Papiamentu, Palenquero, and Saramaccan, discrete prosodic typologies are mixed to create new hybrid systems, arguably due to contact between European languages and West African substrates (Gooden, Drayton, & Beckman, 2009).[13] The Papiamentu (Portuguese-based creole) lexicon for example is realized with combined tone and stress (Remijsen & van Heuven, 2005; Remijsen, Martis, & Severing 2014). Lexical tone contrasts between Tone I (HL) and Tone II (LH). Stress, manifested by higher pitch (Pickering & Rivera-Castillo, 2008) and longer syllable duration (Remijsen & van Heuven, 2005), may fall on the penult or the final syllable. This yields three word-level tone x stress patterns: (1) Tone I x penult stress, (2) Tone II x penult stress, and (3) Tone II x final stress.

Palenquero Spanish lexicon Creole also displays a mixture of Bantu lexical H/L tone contrast and Spanish word-level stress contours (Hualde & Schwegler, 2008). Speakers invariably associate stress with a lexical H tone and left L tones unstressed, making Palenquero Creole distinct from other Caribbean Spanish varieties. Hualde and Schwegler concluded that the peculiar word-level contours arise from Bantu substrates during creole formation.

Saramaccan (Good 2004a, 2004b, 2009) illustrates a rather different type of hybrid system with two clearly differentiated lexical strata. One deals with words of West African origin with

[13] Note, however, that not every hybrid prosodic system can autonomously be attributed to language contact (Gooden *et al.*, 2009). For instance, the tonal phonology of Stockholm Swedish (Riad, 2006) is realized in the combination of a lexical tone and a prominence tone at the phrase-level. This is not necessarily a product of language contact.

lexically specified H/L tones. The other includes words of Portuguese and English origin, with context-dependent tone assignment and a culminative high tone (a "pitch accent") on the syllable with primary stress in the cognate word in the lexifier languages.

To sum up, the sociohistorical background and the linguistic ecological context of language contact differ from one community to another. This has immediate impact on the outcome of contact on prosody as we see that speakers produced diverse prosodic variation patterns, including L2-to-L1 transfer, bi-directional transfer, fusion, and hybridization, in their speech. It is worth noting that while prosodic structure is highly language-specific and the contact situations vary, it seems that the contact-influenced phonological variations are not totally random. Rather, the cases surveyed reveal some common tendencies across contact settings. On the linguistic side of things, I found that when different prosodic typologies meet, speakers produced hybridized patterns. When the contact languages are of similar prosodic typologies, the relative language status and whether speakers face social pressure from L2 (speakers) determine the linguistic outcomes. In this regard, bi-directional transfer is more likely to occur in sociolinguistic settings where languages share equal status and the speakers are free from social pressure. Otherwise, a fusion pattern is more likely to occur (Table 4) (See also in discussions in the EPILOGUE).

Table 4. Sociolinguistic factors and contact-based prosodic variation

		Linguistic factor: Prosodic typology	
		Different (e.g., stress language vs. tone language)	Similar (e.g., stress language vs. stress language)
Social factors: Language status & Social pressure from L2	Unequal status & Pressure from L2	Hybridization	Fusion
	Similar status & No/mild pressure		Bi-directional

Given the current linguistic ecological context on Orchid Island (Section 1.2) – i.e., contact between distinct prosodic typologies (Yami: stress language vs. Mandarin: tone language), unequal status between Yami and the socially-dominant Mandarin, and socioeconomic pressure for the Yami people, I show that the prosody in Yami also exhibits hybridizations.

2.3 YAMI AND TAIWANESE MANDARIN INTONATIONS: AN OVERVIEW

2.3.1 Taiwanese Mandarin

2.3.1.1 Linguistics background

Mandarin belongs to the Sinitic branch in the Sino-Tibetan family. Standard Mandarin is developed from Northern Mandarin dialect spoken in Beijing, with some lexical and syntactic influence from other Mandarin dialects (Figure 6). Taiwanese Mandarin is one variety of Standard Mandarin spoken in Taiwan since 1945. After decades of political separation, coupled with the difference in ethnic distribution between Taiwan and China, Taiwanese Mandarin has developed independently and shows influence from Taiwanese Southern Min (Fon & Hsu, 2007: 240), the ethnic language with the largest population in Taiwan.[14]

[14] Taiwanese Southern Min is native to 74.3% of 23 million of Taiwanese (Huang, 1993: 21; Ang, 2002). However, it is Mandarin, the language used by a small political elite group (13%), that enjoys the highest prestige and status.

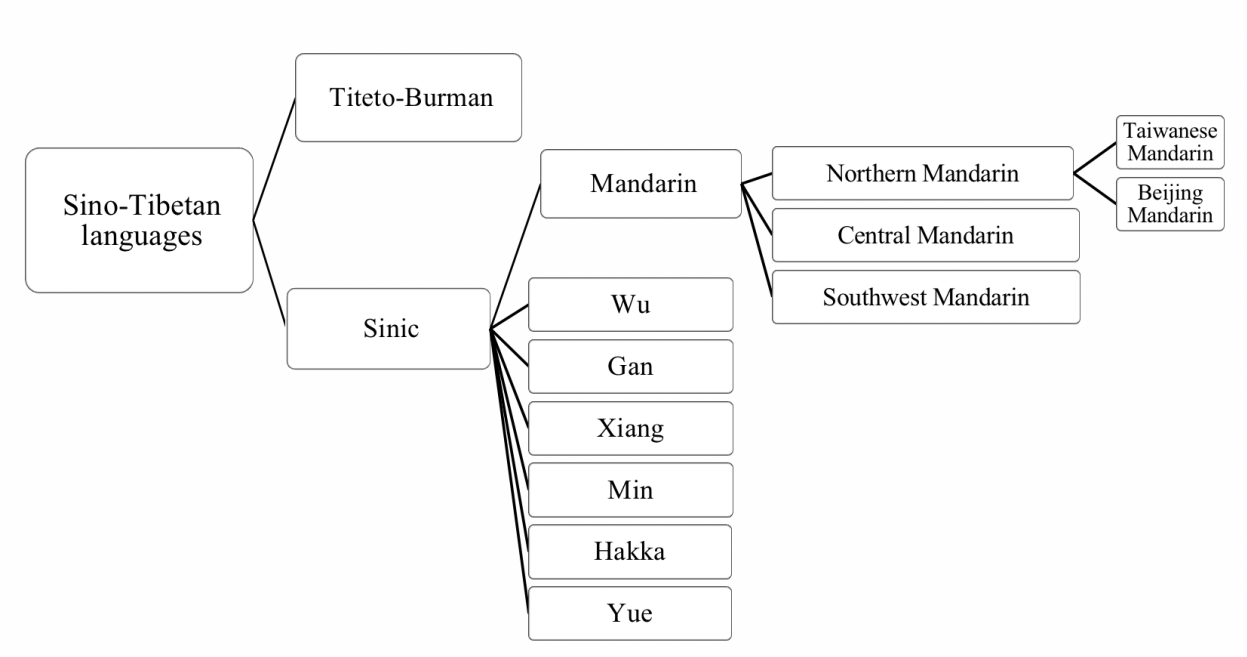


Figure 6. The position of Taiwanese Mandarin in the Sino-Tibetan language family

Source: Ethnologue: Languages of the World

Mandarin serves as the official language of Taiwan, China, and as one of the four official languages of Singapore. According to Ethnologue (2015), it is spoken by more than 1.7 billion speakers worldwide.

2.3.1.2 Sentence formation and intonation

Mandarin is a tone language with four contrastive lexical tones plus one neutral tone. Morpho-syntactically, Mandarin is an isolating language with very limited affixational morphology. Hence, sentences have to follow strict word orders.

Mandarin statements are constructed using a Subject-Verb-Object order and take a falling intonation (Chuang, Huang, & Fon, 2007; Chuang & Fon, 2016). Questions, on the other hand, are of varying types. WH-questions are syntactically marked by WH-words (varied positions) and

have a falling intonation like in statements. YES/NO questions contain several subtypes in terms of their syntactic frame and pragmatic meanings. First, YES/NO questions can be constructed by attaching the question particle *-ma* to the end of the statement to seek information from the addressee. Due to the lack of presupposition, this kind of question is considered a neutral question. Alternatively, YES/NO questions can be formed by echoing the statement uttered earlier in the context with a rising intonation to express incredulity/surprise. Since this kind of question is constructed out of a statement, it is termed as a statement question. In some contexts, the *-ma* particle may be added to the end of a statement question to express a *lighter* degree of incredulity.

Researchers (Chuang *et al.*, 2007; Chuang & Fon, 2016) further noted interaction between pragmatics, syntax, and intonation such that statement questions (with or without *-ma*) are overall higher in pitch and have wider final pitch expansion than neutral questions. Within statement questions, those *without -ma* are higher in pitch and have larger pitch range than those with *-ma* (Table 5).

Table 5. Mandarin sentence construction and intonation (Chiang, 1997; Chuang *et al*., 2007; Chuang & Fon, 2016)

Sentence type		Construction	Schematized intonation
ST		[t^ha^1 ʂɻ^4 i^1ʂəŋ^1] (s)he COP verb, to be doctor *'(S)he is a doctor.'*	Falling 
WHQ		[i^1ʂəŋ^1 tsai^4 na^3li^3] doctor existential verb, appear where *'Where is the doctor?'*	Falling 
YNQ	NQ	[t^ha^1 ʂɻ^4 i^1ʂəŋ^1 ma^0] (s)he COP verb, to be doctor PAR *'Is (s)he is a doctor?'*	Mid level ~ Mid shallow falling
	SQ1	[t^ha^1 ʂɻ^4 i^1ʂəŋ^1] (s)he COP verb, to be doctor *'(S)he is a doctor!?'*	High rising 
	SQ2	[t^ha^1 ʂɻ^4 i^1ʂəŋ^1 ma^0] (s)he COP verb, to be doctor PAR *'(S)he is a doctor!?'*	High level ~ High shallow falling

Abbreviations: COP = copular; PAR = particle. For Mandarin lexical tone, Chao (1968) proposed a 5-level numerical scale to represent pitch height, with 1 being the lowest pitch value and 5 the highest within a speaker's pitch range. In Taiwanese Mandarin, tone 1 is a high-level tone with a value of 44; tone 2 is a mid-rising tone with a value of 24; tone 3 is a dipping tone with a value of 312; and tone 4 is a high-falling tone with a value of 42 (Fon & Chiang, 1999).

Note: While both NQs and SQ2s are characterized by level ~ shallow falling pitch contours, they differ in pitch height. SQ2s are higher in pitch than NQs.

2.3.2 Yami

2.3.2.1 Linguistics background

Albeit politically belonging to Taiwan, Yami is descended from the Northern Philippine languages, a subgroup under the Western Malayo-Polynesia branch in the Austronesian language family (Blust, 1999; Ross, 2005), as seen Figure 7.

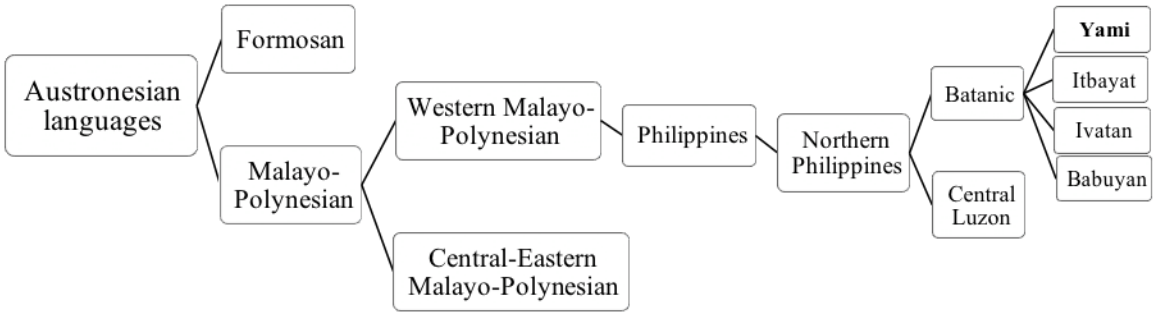
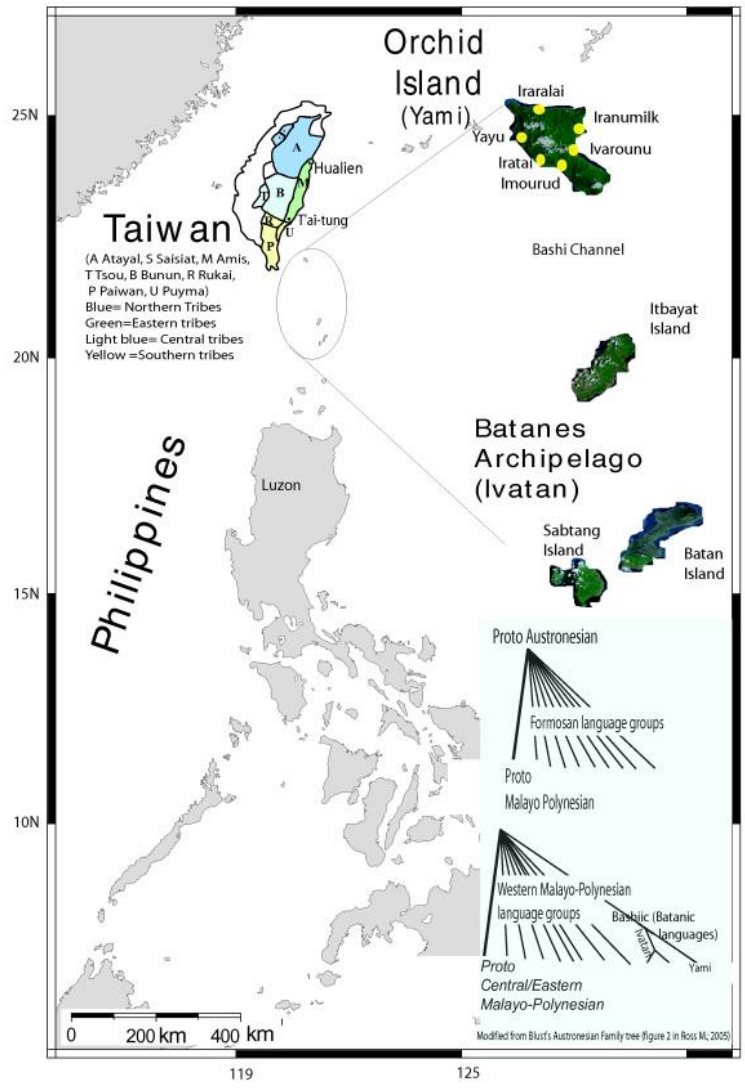


Figure 7. The position of Yami in the Austronesian language family (after Blust, 1999; Ross, 2005)

Based on anthropological and linguistic evidence, researchers (Blust, 1977; Li, 1997: 27f) estimated that the Yami migrated from the Batanes archipelago in the Philippines to Orchid Island approximately five to seven hundred years ago. A more recent study (Loo, Trejaut, Yen, Chen, Lee, & Lin 2011) has also confirmed the genetic affinities between the Yami people and the inhabitants of the Batanes islands (Map 3). Over the past decade, cultural exchange events have been held between Orchid Island and the Batanes islands. Anecdotally, even after centuries of separation, Yami and Itbayat (Figure 7) are still highly mutually intelligible by the speakers of either language.



Map 3. Genetic affinities between the Yami people of Orchid Island and the Philippine Islanders of the Batanes archipelago (Loo *et al.*, 2011)

2.3.2.2 Sentence formation and intonation

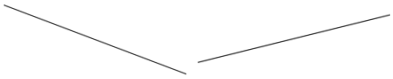
Morpho-syntactically, Yami is an agglutinating language involving extensive affixation and reduplication. Compared to Mandarin, Yami sentences have relatively free word order. It has been argued that Yami statements follow a Verb-Subject-Object order, with the subject often being dropped (Chang, 2000: 63-65; Rau & Dong, 2006: 91). In conversations and narrative style, the

younger generation (under 50 years of age) prefers the Subject-Verb-Object order, possibly due to language contact with Mandarin (Rau & Dong, 2006: 97). Interestingly, Yami speakers utilize similar strategies to Mandarin speakers in question formation: WH-questions are marked by WH-words, which may occur sentential- initial or finally. For YES/NO questions, both neutral and confirmation-seeking questions are constructed out of a statement construction. An optional particle *-ri/ja* can be attached to a YES/NO question.

Yami is a stress language with default final stress (Rau & Dong, 2006: 82). Recent work by Lai & Gooden (2016a) suggested that Yami speakers employed pre-boundary syllable duration to encode prosodic structure (syllable duration: IP > PhP > word). Phrase-final F_0 slope also cues prosodic boundaries. The mean F_0 slope for IP boundary tones (despite slope direction) is steeper than that of the corresponding PhP tones. Research (Lai & Gooden, 2015) also indicated the independence of word- and sentence-level prosody. When different levels of prosody coincide, the lower-level word prosody may be overridden by higher-level sentence prosody.

Yami intonation was not systematically examined until recently, partially because as a vanishing language, it is very challenging to recruit multiple speakers to see common properties of language intonation (Jun & Fletcher 2014: 503-505). So far, we only know that Yami statements and WH-questions end with a low edge tone (L%), whereas confirmation-seeking questions display a terminal rise (H%) (Lai & Gooden, 2015). Neutral question intonation is less clear. The pilot study revealed an association between speakers' language background and their intonation. Yami-dominant bilinguals employed a falling pattern, while Mandarin-dominant bilinguals adopted a rising pattern. No clear pattern was observed in Yami-Mandarin bilinguals as they had both types of boundary tones (Table 6). I suspect that the default pattern of Yami neutral question might be a falling one, and this dissertation aims to provide additional data on this.

Table 6. Yami sentence construction and intonation (Lai & Gooden, 2015, 2016a)

Sentence type		Construction	Intonation
ST		[ɲi-koman-ko ɹana ʂo ʂoʤi] past-eat-1sg.NOM already OBL taro *'I ate taros.'* (VSO order) or [ko-ɲi-mad͡ʒita so aɖoa ka koiʂ] 1sg.NOM-past-see OBL two CL pig *'I saw two pigs.'* (SVO order)	Falling 
WHQ		[ikoŋ mo ɲi-mad͡ʒita] what 2sg.GEN past-see *'What did you see?'*	Falling 
YNQ	NQ	[kaɲio ɹana mabʂui jan] 2pl.NOM already full PAR *'Have you finished with your meal?'*	Yami-dominant bilinguals: Falling  Mandarin-dominant bilinguals: Rising  Balanced-bilinguals: Falling or Rising 
	SQC	[aɖoa ka koiʂ] two CL pig *'(You saw) two pigs?'* Truncated statement (conversation style)	Rising 

Abbreviations: NOM = nominative case; OBL = oblique case; CL = classifier; GEN = genitive case; PAR = particle

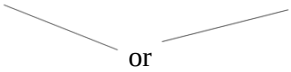
2.4 RESEARCH OBJECTIVES

2.4.1 What is missing from previous literature?

Section 2.2 reviews prosodic change in various contact scenarios. Results show that speakers displayed divergent outcomes encompassing L2 borrowing, bi-directional transfer, and fused patterns in their speech. However, the bulk of studies discuss the contact between similar prosodic typologies. Our understanding of contact between distinct prosodic typologies is still severely constrained. More attempts are thus necessary to illuminate this underexplored yet intriguing area of research.

Section 2.3 compares Mandarin and Yami intonations. Results reveal some discrepancies and gaps between pre-existing literature. Mandarin intonation has been well studied, but not much attention has been paid to confirmation-seeking question intonations so far. Discussion on Yami intonation, in contrast, is relatively new, and more research is needed to clarify neutral question intonation. Additionally, whether Yami speakers also use statement questions to express incredulity/surprise as Mandarin speakers do remains undiscovered (Table 7). In light of the endangered status of Yami, it is crucial to provide timely description of Yami intonation to remedy the gaps in existing literature.

Table 7. Mandarin-Yami comparison

Sentence type		Mandarin		Yami	
		Construction	Intonation	Construction	Intonation
ST		Subject-Verb-Object		Verb-Subject-Object or Subject-Verb-Object	
WHQ		WH-word		WH-word	
YNQ	NQ	ST-*ma*		ST-*ri/ja*	 or
	SQC	Unexplored		ST-*ri/ja*	
	SQ1	ST		Unexplored	
	SQ2	ST-*ma*		Unexplored	

Abbreviations: ST = statement; WHQ = WH-question; YNQ = YES/NO question; NQ = neutral question; SQC = confirmation-seeking questions; SQ1 = default statement question; SQ2 = statement question with *lighter* degree of incredulity

2.4.2 Research objectives

This dissertation aims to investigate bilinguals' Yami and Mandarin productions to see *whether there is evidence of contact-induced prosodic change in their intonation patterns*. This is achieved in two steps.

2.4.2.1 Description of Yami intonation

I conducted a thorough analysis of Yami intonation, with particular attention to neutral questions and two types of statement questions (cf. Table 7). The combined results of this dissertation and pre-existing research (Lai & Gooden, 2015, 2016a, 2018a, 2018b) complement our understanding of what the intonation system looks like in Yami. This then allows me to pinpoint prosodic differences between Yami and Mandarin to determine which Mandarin prosodic components might be more apt to be transferred to Yami, and vice versa.

2.4.2.2 Prosodic change in Yami-Mandarin bilingual intonation patterns

Prosodic structure is highly language-specific and the contact situation differs significantly from one community to another. This makes the outcomes of language contact on the phonological (sound) system highly complex and unpredictable (Gooden *et al.*, 2009). Studying bilingual intonation allows us to see whether speakers keep distinct prosodic systems separate or whether they introduce changes into their systems. When there are prosodic variations, I would like to investigate in what direction prosodic change takes place (Sections 6.3). For instance, whether bilinguals show bidirectional transfer (Mennen, 2004), a fused pattern not attributable to either input system (Queen, 2001), or a hybrid system combing discrete inputs from histo-genetically unrelated source languages (Good, 2004a, 2004b, 2009; Remijsen & van Heuven, 2005; Hualde & Schwegler, 2008; Remijsen, Martis, & Severing, 2014).

3.0 METHODOLOGY

Even though a Yami narrative corpus (Rau & Yang, 2005), dictionary (Rau & Dong, 2008), and reference grammar (Rau & Dong, 2005; Rau, Dong, & Chang, 2016) are readily available online, there is still a need to establish a Yami speech prosody corpus because current corpora have predominantly focused on morphosyntax, leaving intonation and prosody a significant gap in Yami linguistics. Methodologically, data collection methods in morphosyntax documentation may not be well-suited for intonation study because traditionally, field linguists often work with only one (or a few) language consultant(s) (Himmelmann, 2006; Himmelmann & Ladd, 2008). Since intonation varies widely across speakers, collecting data from multiple speakers makes researchers better positioned to find common properties of language intonation (Jun & Fletcher 2014: 503-505). To build the Yami speech prosody corpus, I proposed a new paradigm, the Interactive Card Game, to facilitate elicitation of spontaneous speech in Yami and in cross-linguistic/cross-cultural settings.

This chapter is divided into three parts. Section 3.1 deals with participant recruitment and suggests a refined approach to speaker classification in endangered language communities. Section 3.2 discusses some limitations of pre-existing elicitation techniques and then gives a detailed layout about the new paradigm for data collection. Section 3.3 describes data analysis plans.

3.1 PARTICIPANTS

The main field work was conducted on Orchid Island, Taiwan, from June through August in 2017. In order to gain access to the community, I boarded with a Yami family during the fieldtrip. I worked with members of the family, the Society for Conservation of Lanyu Wildlife and Nature, and three local guides who helped me gain access to community members (especially the more conservative Iraratay village). In total, 44 participants were recruited for this study. As discussed below, a refined tool for speaker categorization was proposed.

3.1.1 Speaker typology in dying language communities: Beyond language competence

Attempts have been made to classify speakers of endangered languages. Using language proficiency as a measuring stick, speakers have traditionally been categorized as full speakers, semi-speakers, and terminal speakers (Dorian, 1981, 1994a; Sasse 1992a; Grinevald, 2003) (see Section 2.1).

Setting up the classification builds a crucial connection between speaker typology, speech behavior, and linguistic consequences. However, looking at language competence alone is insufficient as speech behaviors are interlaced with the complex sociopolitical nature of the contact situation and with individual psychology (Haugen, 1972: 325; Mufwene, 2001: 15-19; Grinevald, 2003). In this dissertation, I revisited the framework by taking different levels of bilingualism (Weinreich, 1968: 71-82) and multiple factors into consideration. To facilitate categorization, a modified Language Experience and Proficiency Questionnaire (LEAP-Q) (Marian, Blumenfeld, & Kaushanskaya, 2007) was administered to assess information about participants' self-reported language dominance, first acquired language at preschool age, relative percentages of language

use in present-day social interactions, education level, and residential, travel, and work experience (see APPENDIX A).

3.1.1.1 Guidelines for coding

In general, a more Yami or Orchid Island-oriented response was coded as Y; a more Mandarin or Taiwan-oriented response, M. In cases where "balanced or roughly the same" best described the situation, a B was labeled.

(a) Self-reported language dominance: while the Council of Indigenous Peoples in Taiwan has continued to promote the indigenous language proficiency test, only a small number of Yami teachers have passed this test. Due to the lack of a standardized test score, I asked the participants to self-report instead. If the participant reported to be more fluent in Yami, (s)he got a Y for this parameter; otherwise, a M was labeled. If the participant reported to be equally fluent in both languages, a B was labeled.

(b) First acquired language at preschool age: if the participants acquired Yami at preschool age, a Y was labeled; otherwise, a M was labeled. If the participant claimed that (s)he acquired both languages concurrently, a B was labeled.

(c) Relative percentages of language use in present-day social interactions: if the participant use Yami more than Mandarin by 30% in daily conversations, a Y was labeled; otherwise, a M was labeled. In cases where the participants use both languages at roughly the same rates, a B was labeled.

(d) Education level: the first and only senior high school (10-12 grade), the Lanyu Senior High School, was established in 1987 (Tsai, 2009: 40). Prior to this, the islanders had to seek higher education in Taiwan. Plus, since Mandarin has been the only medium of instruction

in higher education in Taiwan, it is reasonable to use whether the participant completed high school degree as the dividing line separating those who have stronger bindings with Taiwan/Mandarin (labeled as M) from those who have weaker connections with Taiwan but stronger affiliations with Orchid Island/Yami (labeled as Y).

(e) Residential, travel, and work experience after 15 years old: as discussed right above, in earlier years, the islanders either traveled to Taiwan to pursue higher education or seek job opportunities after finishing junior high school at the age of 15. Therefore, I calculated the ratio of years the participant lived or worked in Taiwan to the years (s)he lived on Orchid Island after the age of 15 to gauge the degree of integration with Taiwan/Mandarin. A value of 0.8 or greater was coded as a M; otherwise, a Y was labeled.[15]

Possible responses to the five parameters and the corresponding codings are seen in Table 8.

Table 8. Speaker classification and coding

Parameters	Possible responses	Coding
1. Self-reported language dominance	Yami > Mandarin	Y
	Mandarin > Yami	M
	Equally fluent	B
2. First acquired language at preschool age	Yami	Y
	Mandarin	M
	Both as the first acquired languages	B
3. Relative percentages of language use in present-day social interactions	Yami > Mandarin by 30%	Y
	Mandarin > Yami by 30%	M
	Roughly the same (e.g., 50% vs. 50% or 60% vs. 40%)	B
4. Education level	Junior high school or less	Y
	Senior high school or higher	M
5. Residential, travel, and work experience after 15 years old	Ratio of years in Taiwan/years on Orchid Island ≥ 0.80	M
	Ratio of years in Taiwan/years on Orchid Island < 0.8	Y

[15] Although we cannot totally preclude the influence from other languages such as Taiwanese Southern Min and English, in this dissertation, I will focus on the contact between Yami and Mandarin.

3.1.1.2 Grouping

Based on survey responses, participants were classified into near Yami-monolingual, Yami-dominant bilingual, balanced bilingual, Mandarin-dominant bilingual, and ethnically Yami but linguistically Mandarin-monolingual groups. Participants showing the strongest connection with Orchid Island/Yami received five Ys and were categorized as near Yami-monolinguals or Yami-dominant bilinguals. Both groups acquired Yami first and used Yami as their primary language, but they contrasted in their Mandarin fluency and in their residential and work experience. Yami-monolinguals often carried heavy Yami accent in their disfluent Mandarin and had nearly spent their entire life on Orchid Island. Yami-dominant bilinguals, on the other hand, could handle Mandarin well and had typically spent a couple of years working and living in Taiwan.

Based on the above criteria (Table 8), participants having closer bonds with Taiwan/Mandarin were classified as balanced or Mandarin-dominant bilinguals. Although both groups had lived in mainland Taiwan for more than a decade, they differed fundamentally in their language dominance, first acquired language, and language use patterns. Balanced bilinguals identified Yami or both Yami and Mandarin as their first acquired language(s) and still showed full competence in Yami. Therefore, Yami is still used to varying degrees in their daily conversations. Mandarin-dominant bilinguals usually acquired Mandarin first. Due to flawed Yami speaking skills, they only used Yami in limited settings.

Since prosodic change can occur bi-directionally (Mennen, 2004), a group of ethnically Yami, linguistically Mandarin-monolinguals were also recruited. The younger speakers (age range 19-33) learned Mandarin first and could barely speak Yami. On top of that, they may have moved to Taiwan before the age of 15 while their parents were working in Taiwan.

Recruiting participants from diverse sociolinguistic backgrounds is crucial as it has the potential to gauge degrees of Mandarin influence on Yami and also how Yami affects Mandarin along the bilingual continuum.

All participants were recruited using a snowball sampling technique, as in the earlier fieldwork. Although I made efforts to recruit as many Yami-monolinguals as possible, a culturally significant event intervened. Specifically, my host parents' mother passed away during my fieldtrip. According to Yami rituals, there is a one-month period of mourning for those who are affected, and it is highly offensive to visit others' place during this period. Since I stayed with the family, I was also considered a family member and was therefore required to follow the local norm. It is worth noting that middle-aged and younger islanders were more flexible with this norm and were willing to participate in my research, while older speakers took this very seriously and were thus reluctant to serve as my participants. This difference in cultural behavior mimics the differences in language choices and language attitudes. A simplified participant profile is summarized in Table 9 (see APPENDIX B and Table 47 for the full summary).

Table 9. Participant profile

Speaker typology	Coding	# of participants (Age range)	Language dominance	1st acquired language	% of language use	Education level	Years in Taiwan/ Orchid Island
YM	YYYYY	5 (60-69)	Yami > Man	Yami	Yami > Man	ES or less	0.16
YD	YYYYY YYYYB YYYYM	12 (55-62)	Yami > Man	Yami	Yami > Man	JH or less	0.42
BB	YYYMM YYBMM YYMMM	12 (42-56)	Yami > Man Yami = Man Man > Yami	Yami Yami & Man	Yami = Man	JH or SH	2.66
MD	BMMMM MMMMM	8 (25-38)	Man > Yami	Man	Man > Yami	SH or CL	3.87
MM	MMMMM	7 (19-33)	Man	Man	Man	SH or CL	0.86[16]

Abbreviations: YM = Yami-monolingual, YD = Yami-dominant bilingual, BB = balanced bilingual, MD = Mandarin-dominant bilingual, MM = Mandarin-monolingual in the leftmost column. When referring to languages, Man = Mandarin. In the education level column, ES = elementary school, JH = Junior high school, SH = senior high school, and CL = college or equivalent

3.2 INTERACTIVE CARD GAME: TASK DESIGN AND CORPUS COLLECTION

This section briefly reviews pre-existing techniques for elicitation and justifies the need to develop a new paradigm workable in indigenous communities. Then, a detailed description is provided to demonstrate how to perform the tasks.

[16] For Mandarin-monolinguals, the ratio was calculated by dividing the years in Taiwan by the years on Orchid Island. This modification is necessary because this group of speakers did not necessarily grow up on Orchid Island. Instead, they might have grown up and received education in Taiwan while their parents were working in Taiwan.

3.2.1 Previous paradigms for spontaneous elicitation

3.2.1.1 The Map Task

In intonational fieldwork, paired interactive dialogues facilitate collecting natural speech while still having controlled material (Jun & Fletcher, 2014: 505-512). The most commonly used approach is the Map Task (Anderson, Bader, Bard, Boyle, Doherty, Garrod, Isard, Kowtko, McAllister, Miller, Sotillo, Thompson, & Weinert, 1991), in which one participant serves as the instruction-giver and the other as the instruction-follower (e.g., Grice, Benzmüller, Savino, & Andreeva, 1995; Lickley & Bard, 1998; Koiso, Horiuchi, Tutiya, Ichikawa, & Den, 1998; Stirling, Fletcher, Mushin, & Wales, 2001; Mushin, Stirling, Fletcher, & Wales, 2003; Mixdorf, 2004; Lai & Gooden, 2015, among others).

Despite its popularity, Fon (2006) has identified two limitations regarding the Map Task dialogues. First, the roles assigned to the two participants are not equal. The instruction-giver acts as the major contributor of the dialogue, and the instruction-follower often plays a lesser role. Another limitation of the Map Task lies in its cultural dependency. Many of the landmark icons on the maps rely heavily on cultural contexts, making it difficult to design comparable corpora for a variety of languages.

To tackle these constraints, Fon (2006) proposed a new technique, the Shape Display, which ensures spontaneity and equal dialogue status between the participants. It is also culturally independent to permit the construction of multilingual corpora.

3.2.1.2 The Shape Display

The Shape Display is a cooperative board game that requires a pair of participants to show exactly the same layout on the two boards. The game pieces differ in the shapes (circle, oval, triangle, square, rectangle, and star) and colors (red, yellow, light green, dark green, light blue, and dark blue).[17] All pieces (6 shapes x 6 colors = 36) are mixed well and put into a pocket. The experimenter randomly picks six pieces out of the pocket and places them on each board in random order (Figure 8).

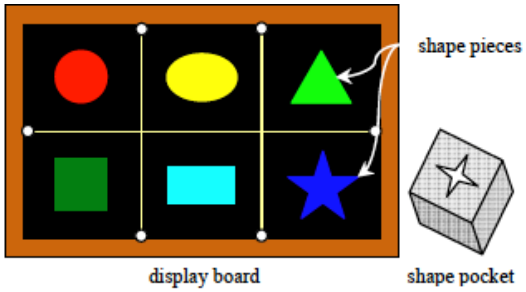


Figure 8. Schematization of the Shape Display game (from Fon, 2006)

The participants can switch positions of existing pieces on the boards or draw new pieces out of the shape pocket. They should try to minimize the number of pieces they use throughout the game. The one that uses the least pieces "wins" the game. According to Fon (2006), the novel device worked well as the participants take turns in leading the dialogue and it is suitable for establishing a multilingual corpus (English, Taiwanese and Beijing Mandarin, and Japanese).

[17] According to Fon (2006), these are relatively common color terms across languages. Two shades of green and blue are included so that possible focus contrasts can be elicited.

Although the Shape Display can effectively elicit spontaneous data from different languages, it presents some challenges to speakers of indigenous languages, as these languages often lack elaborate color and shape terms. Yami, for instance, has only four basic color terms (red, black, white, and green/blue), and there are virtually no specific terms to denote geometric shapes.

Even though I made efforts to replace these shapes and colors with basic Yami vocabulary, the inevitable use of directional terms introduced another issue to impede the smooth running of the dialogue. To illustrate, according to my fieldwork notes (Lai, 2009, 2011, 2015), the use of directional terms is largely male-oriented and has now dropped substantially in daily conversations. For the former, fishing has traditionally been considered men's work in the Yami society. To navigate at sea, Yami men are more familiar with directional terms than Yami women. Even so, with increasing use of motor boats and automatic navigation, the directional terms are becoming very low frequency words for most Yami speakers. My previous fieldwork experience (Lai, 2009, 2011, 2015) showed that participants usually found it difficult to retrieve these words from their linguistic repertoires. To proceed with the task, participants simply code-switched to Mandarin.

To overcome this limitation, a new elicitation paradigm, the Interactive Card Game, was designed. The new technique shows two strengths. First, it permits equal spontaneous elicitation. Second, it is dynamic in the potential for variety. Researchers can easily embed target sentences in the task and modify the type and number of cards accordingly to suit individual needs in wider cultural settings. Details on task design and corpus collection are provided below.

3.2.2 A new spontaneous elicitation paradigm: The Interactive Card Game

Seven utterance types were targeted: statement, narrow focus statement, WH-question, neutral question, confirmation-seeking statement question, default statement question, and statement question with *lighter* degree of incredulity. Since these sentence types will be repeatedly referred to throughout the dissertation, for simplicity, they will be abbreviated as statement (ST), narrow focus statement (NF), WH-question (WHQ), neutral question (NQ), confirmation-seeking statement question (SQC), default statement question (SQ1), and statement question with *lighter* degree of incredulity (SQ2).

To compare sentence types across pragmatic conditions, the sentence-final lexical content was kept constant. Target items were six disyllabic, final-stressed basic Yami words whose Taiwanese Mandarin equivalent was also disyllabic but with identical adjacent tones. These six target items were inserted into a carrier sentence under each pragmatic condition. Ten words were also included as fillers (Table 10).

Table 10. Task words and the corresponding pictures

Target lexical items			
Yami word	Taiwanese Mandarin equivalent	Gloss	Picture
[a.ŋit]	[tʰjɛn^{1}.kʰʊŋ^{1}]	'sky'	
[ɮi.la]	[ʂɤ^{2}.tʰoʊ^{2}]	'tongue'	
[a.jo]	[xɤ^{2}.ljoʊ^{2}]	'river'	
[a.taʊ]	[xaɪ^{3}.ʂweɪ^{3}]	'sea water'	
[poŋ.ʂo]	[taʊ^{3}.y^{3}]	'island'	
[və.ʁan]	[ɥœ^{4}.liaŋ^{4}]	'moon'	

Fillers					
Yami word	Gloss	Picture	Yami word	Gloss	Picture
[ɮi.ma]	‘hand’		[ɮi.ɮiʂ.nan]	‘chair, seat’	
[ʂu.ɮi]	‘taro’		[ta.ɮi.ŋa]	‘ear’	
[ta.ɮi.ɮi]	‘clothes’		[ka.ma.ɮiq]	‘boat shelter’	
[ʂa.ɹoʊ.ʂaʊ]	‘breeze’		[i.ɹa.taɪ]	Proper name, village name	
[i.ɹa.ɹa.laɪ]	Proper name, village name		[i.va.ɮi.no]	Proper name, village name	

Three paired interactive tasks, including a card-matching task, a memory card game, and a picture-guessing task, were conducted.

Preparation. Prior to the games, each participant was given a familiarization leaflet, an A3 paper containing the six target items and the ten fillers, to help them become familiar with potential words they would be encountering during the tasks. The sixteen pictures were then arranged in

random order, each with Yami and Chinese captions typed below (APPENDIX C and Figure 54). Participants were unware of the target items and were instructed that the words they would be using during the tasks should not fall outside the range of the sixteen words.

3.2.2.1 Card-matching task

Goal. The task was designed to elicit 6 NQ-ST pairs from each participant.

Equipment and setup. Two decks of cards (16 each) were prepared for each participant to complete this task. The six target items, denoted as A, B, C, D, E, F, were divided into two halves: [A, B, C] and [D, E, F], as schematized in Figure 9.

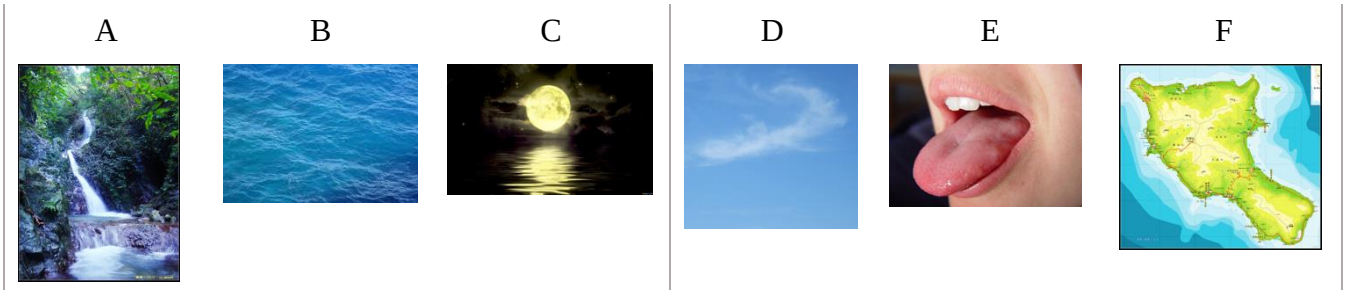


Figure 9. Target items

Each participant was offered a deck of 16 cards. Participant 1 held the three intended targets [A, B, C] (marked with **green** labels) in hand for card-matching. In front of participant 1 was a randomly shuffled deck containing the ten fillers and the three intended targets [D, E, F] from which participant 2 would ask for card-matching. Likewise, participant 2 also held three intended targets [D, E, F] (marked with **pink** labels) in hand, with a shuffled deck consisting of the ten fillers and the three cards [A, B, C] from which participant 1 would seek for card-matching.

Elicitation. The six target items were embedded in NQ and ST pragmatic conditions. Participant 1 attempted to pair up [A, B, C] and started the conversation by asking [ja miɛn imo ʂo A/B/C?]

'Do you have A/B/C?' Participant 2 drew the intended target from the pile right in front of him/her and gave it to participant 1. Once the cards were matched, participant 1 placed the pair aside and said [o jam A/B/C.] *'This is A/B/C.'* Participant 2 (with [D/E/F] in hand) repeated the same procedure to ask for the three targets from participant 1 for pairing (Figure 10).

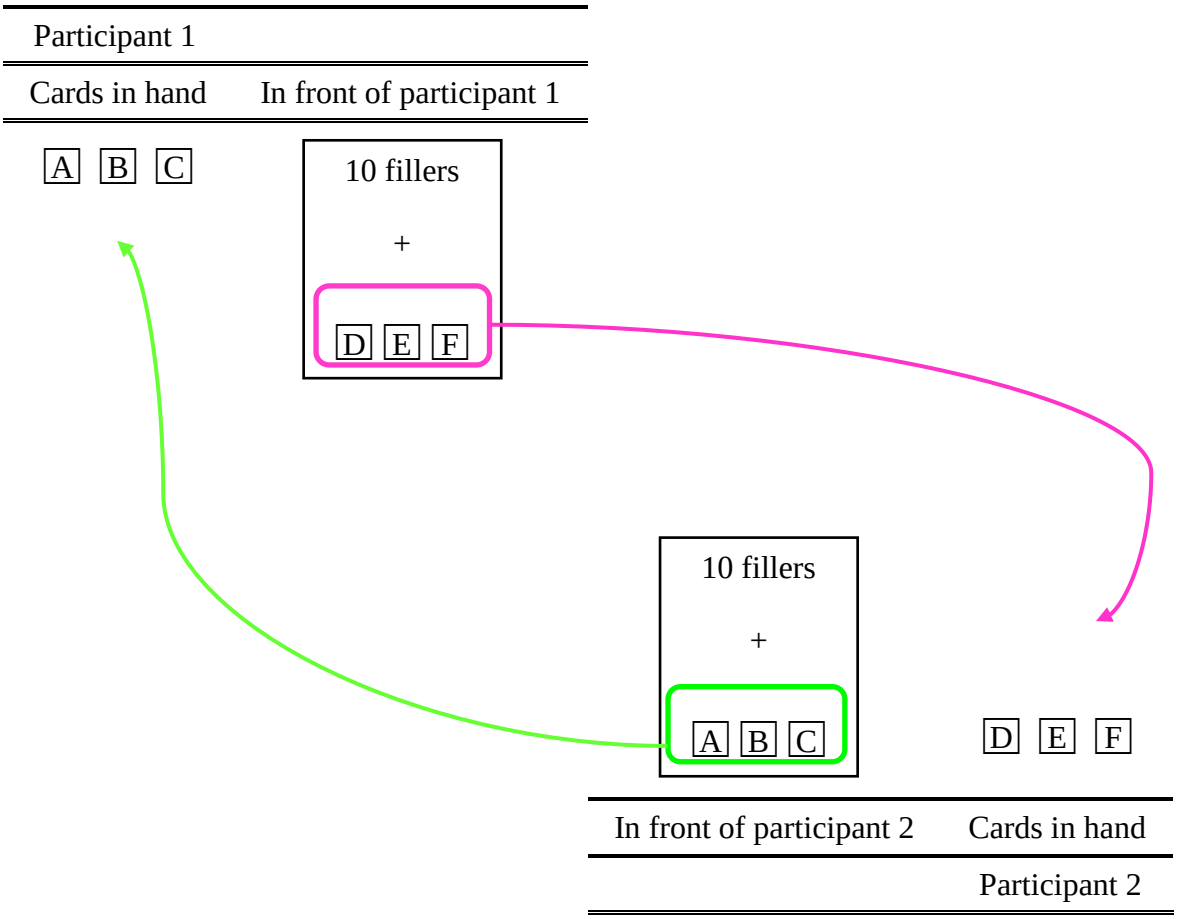


Figure 10. Schematization of card-matching task

The participants took turns to lead the conversation until all cards in their hands were paired up, as illustrated in Figure 11.

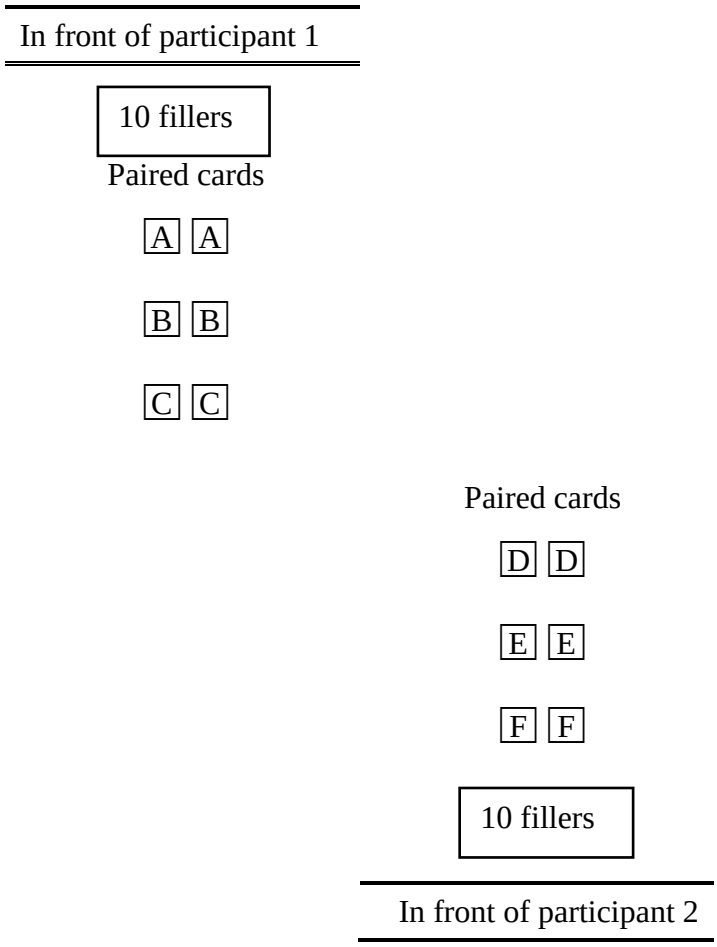


Figure 11. Final layout of the first-round card-matching task

To successfully elicit the six items from each participant, a second round of the card-matching game was conducted. This time participant 1 intended to match [D/E/F] and participant 2 [A/B/C]. Once again, participant 1 initiated the dialogue, and the participants took turns to lead the conversation until running out of the cards in their hands.

3.2.2.2 Memory card game

Goal. The task was devised to elicit 12 WHQ-SQC pairs from each participant.

Equipment and setup. A 6-pocket sleeve, labeled with ordinal numbers from 1 through 6, was prepared for each participant. Participants randomly arranged the six target cards into their own 6-pocket sleeve (Figure 12).

Figure 12. Schematized layout of memory card game

Elicitation. The six target items were embedded in WHQ and SQC pragmatic conditions. Participants showed the layout of their own 6-pocket sleeve to their partner for 5 seconds. Then, the participants took turns to ask each other if they could recall the position of the six items from memory. Participant 1 started the conversation by asking [#1/2/3/4/5/6 am, ikoŋo?] or [ikoŋo no #1/2/3/4/5/6?] *'What is number 1/2/3/4/5/6?'* Participant 2 replied [A/B/C/D/E/F ɹi/jan?] *'Is that A/B/C/D/E/F?'* Participant 1 then responded with "correct" or "incorrect" without further revealing any information. Participant 2 replicated the same procedure to elicit responses from participant 1. The participants took turns to ask each other until they completed all target items. Each participant contributed 6 SQCs with the target words embedded.

To elicit WHQs that contain the six target items, a second round of the game was conducted. This time, the WHQs and SQCs were flipped. Namely, participant 1 initiated the game by asking [ɖo and͡ʒin ɹaja ɹano A/B/C/D/E/F?] or [A/B/C/D/E/F am, ɲikapiɹa?] *'Where is A/B/C/D/E/F?'*, and participant 2 replied [ɖo #1/2/3/4/5/6?] *'Is it in number 1/2/3/4/5/6?'* to seek confirmation. Participant 1 then responded with "correct" or "incorrect" without further revealing

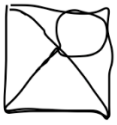
any information. The participants took turns to ask each other until all target words were mentioned. Each participant contributed 6 WHQs with the target words embedded.

3.2.2.3 Picture-guessing task

Goal. This task was designed to stimulate 6 WHQ, SQC, ST, SQ1, NF, and SQ2 responses each from each participant.

Equipment and setup. Each participant received a pile of abstract-drawing cards corresponding to the six target items. To facilitate elicitation, the target each picture represented was written on the back of the card (Figure 13).

Participant 1's cards

Front – Picture			
Back – Answer	sky	tongue	river
Front – Picture			
Back – Answer	sea water	island	moon

Participant 2's cards

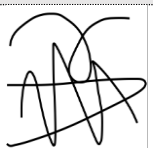
Front – Picture			
Back – Answer	sky	tongue	river
Front – Picture			
Back – Answer	sea water	island	moon

Figure 13. Abstract-drawing cards

Elicitation. Participant 1 randomly drew a card from the pile, showed it to participant 2, and asked participant 2 [ikoŋ o ja?] *'What is this?'* Given the task, I anticipated that participant 2 would have difficulty identifying what the picture represented. (S)he picked up a word (denoted as XYZ) from the familiarization leaflet to seek confirmation [XYZ ja/ɹi?] *'Is it XYZ?'* Participant 1 then revealed the answer and said [bəkən, o jam A/B/C/D/E/F.] *'No, this is A/B/C/D/E/F.'* I anticipated that participant 2 would express incredulity/surprise upon hearing the answer given by their partner and say [koŋo A/B/C/D/E/F ɹi?]/[oŋ jo ta A/B/C/D/E/F ɹi?] *'This is A/B/C/D/E/F!?'* To convince participant 2, participant 1 turned over the card, showed the answer to participant 2, and emphasized (narrow focus) [nonan, **A/B/C/D/E/F** ja.] *'Yes, this is **A/B/C/D/E/F**.'* Assuming that participant 2 still found it unconvincing and said [a A/B/C/D/E/F ja/ɹi!?] *'This is A/B/C/D/E/F!?'* Participants took turns to ask each other until all six cards were used. The conversation flow permitted elicitation of 6 WHQ, SQC, ST, SQ1, NF, and SQ2 responses from each participant.

In total, each participant provided 12 sentences x 6 targets = 72 responses. 48 of them contained the 6 target items (denoted by *, the blanks represent the target positions), as seen in Table 11.

Table 11. Sentence elicitation from card game dialogue

Task 1: Card-matching task			
Participant 1	Pragmatic condition	Participant 2	Pragmatic condition
[ja miɛn imo ʂo __?]* *'Do you have A/B/C?'*	NQ		
[o jam __.]* *'This is A/B/C.'*	ST		
		[ja miɛn imo ʂo __?]* *'Do you have D/E/F?'*	NQ
		[o jam __.]* *'This is D/E/F.'*	ST
[ja miɛn imo ʂo __?]* *'Do you have D/E/F?'*	NQ		
[o jam __.]* *'This is D/E/F.'*	ST		
		[ja miɛn imo ʂo __?]* *'Do you have A/B/C?'*	NQ
		[o jam __.]* *'This is A/B/C.'*	ST
Task 2: Memory card game			
Participant 1	Pragmatic condition	Participant 2	Pragmatic condition
[#1/2/3/4/5/6 am, ikoŋo?] or [ikoŋo no #1/2/3/4/5/6?] *'What is number [1/2/3/4/5/6]?'*	WHQ	[A/B/C/D/E/F] ɹi/jan?]* *'Is that [A/B/C/D/E/F]?'*	SQC
[ɖo and͡ʒin ɹaja ɹano A/B/C/D/E/F?]* or [A/B/C/D/E/F am, ɲikapiɹa?]* *'Where is A/B/C/D/E/F?'*	WHQ	[ɖo #1/2/3/4/5/6?] *'Is it in number [1/2/3/4/5/6]?'*	SQC
Task 3: Picture-guessing task			
Participant 1	Pragmatic condition	Participant 2	Pragmatic condition
[ikoŋ o ja?] *'What is this?'*	WHQ	XYZ ja/ɹi? *'Is that XYZ?'*	SQC
[bəkən, o jam __.]* *'No, this is __.'*	ST	[koŋo A/B/C/D/E/F ɹi?]* or [oŋ jo ta A/B/C/D/E/F ɹi?]* *'This is __!?'*	SQ1
[nonan, __ja.]* *'Yes, this is __.'*	NF	[a __ ja/ɹi!?]* *'This is __!?'*	SQ2

This series of tasks was replicated to collect Mandarin data. Note that Yami-monolinguals only provided Yami data, which yielded 72 (responses) x 5 (participants) = 360 sentences. Likewise, Mandarin-monolinguals only provided Mandarin data, which contributed 72 (responses) x 7 (participants) = 504 sentences. The three bilingual groups provided data in both languages and offered 72 (responses) x 32 (participants) x 2 (languages) = 4,608 sentences altogether (Table 12).

Table 12. Elicitations from each group

	Near Yami-monolingual	Bilingual			Mandarin-monolingual
		Yami-dominant	Balanced bilingual	Mandarin-dominant	
# of participants	5	12	12	8	7
Yami sentences	360	864	864	576	
Mandarin sentences		864	864	576	504
N	360	1,728	1,728	1,152	504

General apparatus and procedure. Data were recorded with a digital voice recorder (Olympus Zoom H4n) and saved to a lossless digital audio file format (.wav) at a sampling rate of 44.1 kHz with 16-bit resolution. A practice session was administered to ensure that participants could faithfully produce different utterance types. In the formal recording session(s), to minimize carryover effect, bilingual participants produced Yami data first. With no sound-attenuated room in the field, as in previous fieldwork, the recording session(s) was done in a quiet room of the participants' house.

Of the 44 participants, 42 of them were paired up. In cases where paired participants were not possible, I worked with the participants (one Yami-monolingual and one Mandarin-monolingual) to complete the tasks.

3.3 DATA ANALYSIS

Seven sentence types were embedded in the three game tasks. This dissertation focused on the five syntactically similar sentences to explore potential interaction between syntax, pragmatics, and intonation. NFs and syntactically marked WHQs were of secondary focus to the study. The sentences analyzed in this dissertation are given in Table 13, and the number of target sentences produced by each group is given in Table 14.

Table 13. Target sentences for analysis

Yami corpus		
Task	Pragmatic condition	Carrier sentence
Card-matching	1. Neutral Question	[ja miɛn imo ꞑo __?]* *'Do you have __?'*
	2. Statement	[o jam __.]* *'This is __.'*
Memory card game	3. Confirmation-seeking Question	[__ ɹi/jan?]* *'Is that __?'*
Picture-guessing	4. Statement Question conveying incredulity (SQ1)	[koŋo __ ri!?]* *'This is __!?'*
	5. Statement Question with lighter incredulity (SQ2)	[a __ ɹi/ja!?]* *'This is __!?'*
Mandarin corpus		
Task	Pragmatic condition	Carrier sentence (tones omitted here)
Card-matching	1. Neutral Question	[ni joʊ __ ma?] *'Do you have __?'*
	2. Statement	[ʐɣ ʂɻ __.] *'This is __.'*
Memory card game	3. Confirmation-seeking Question	[ʂɻ __ ma?] *'Is that __?'*
Picture-guessing	4. Statement Question conveying incredulity (SQ1)	[ʐɣ ʂɻ __!?] *'This is __!?'*
	5. Statement Question with lighter incredulity (SQ2)	[ʐɣ ʂɻ __ ma!?] *'This is __!?'*

Table 14. Number of target sentences by each group

	Near Yami-monolingual	Bilingual			Mandarin-monolingual
		Yami-dominant	Balanced bilingual	Mandarin-dominant	
# of participants	5	12	12	8	7
Yami sentences	150	360	360	240	
Mandarin sentences		360	360	240	210
N	150	720	720	480	210

3.3.1 Acoustic parameters

Previous literature on Taiwanese Mandarin intonation (Chuang *et al.*, 2007, Chuang & Fon, 2016) used phrase-final pitch expansion and pitch height to characterize sentence types. In Yami, final boundary tone, mean F_0 slope, and mean pitch height are important cues to sentence types (Lai & Gooden, 2015; 2018a, 2018b). To facilitate cross-linguistic comparison here, the same parameters – final boundary tone, mean F0 slope, and mean pitch height – were measured in both Yami and Mandarin data.

(a) Final boundary tone was examined based on auditory impression of the pitch movement, coupled with visual inspection of F_0 contour on Praat (version 6.0.17). A ToBI-style annotation for Yami (Lai & Gooden, 2015, 2016a, 2018a, 2018b) was adopted. A rising intonation was labeled as H% (Figure 14), while a falling intonation, L% (Figure 15). In cases where the participants produced a flat pitch contour, a mid tone M% was labeled (Figure 16). Percentages of edge tone (H%, L%, or M%) for each sentence type were calculated to show general intonation pattern.

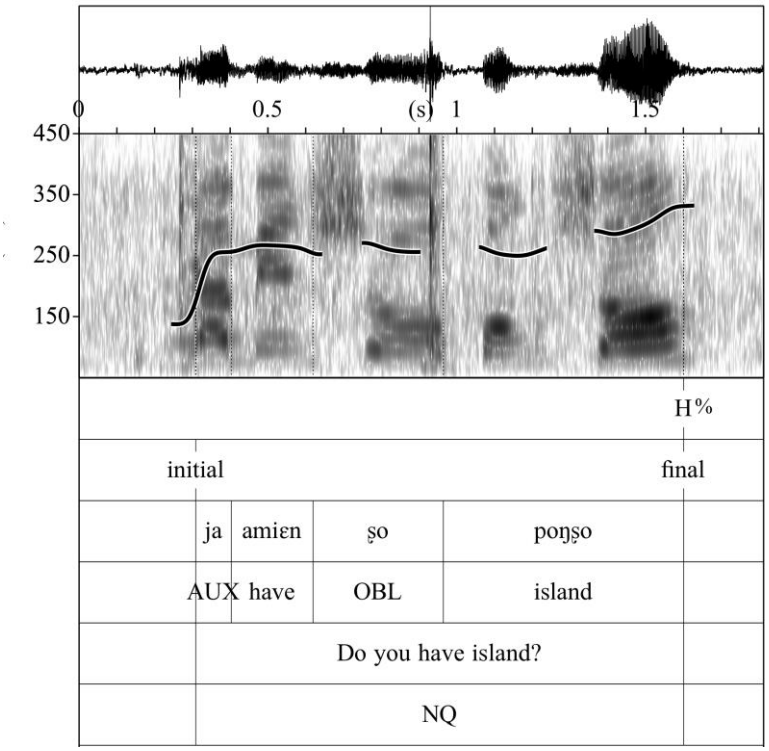


Figure 14. H boundary tone

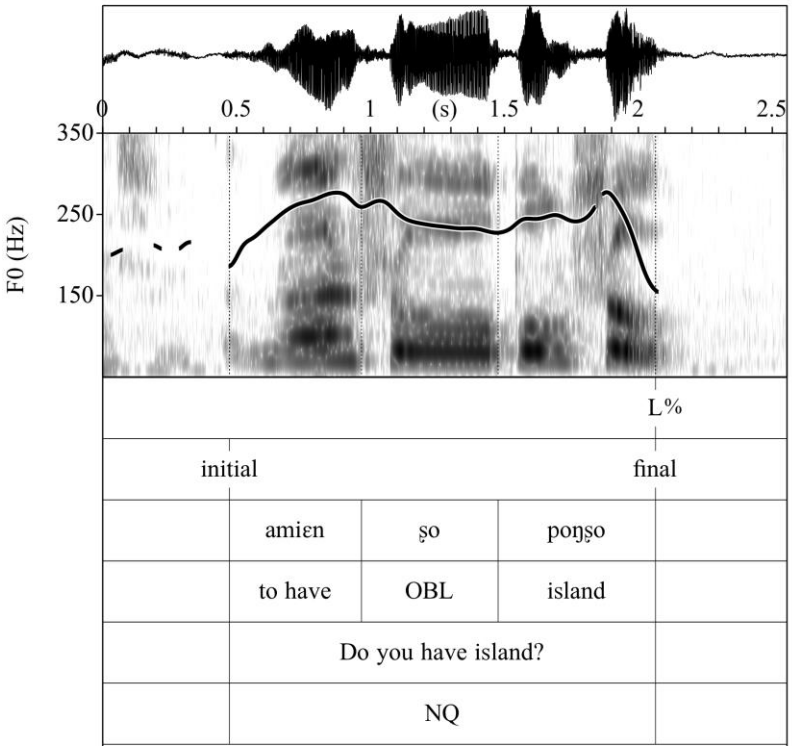


Figure 15. L boundary tone

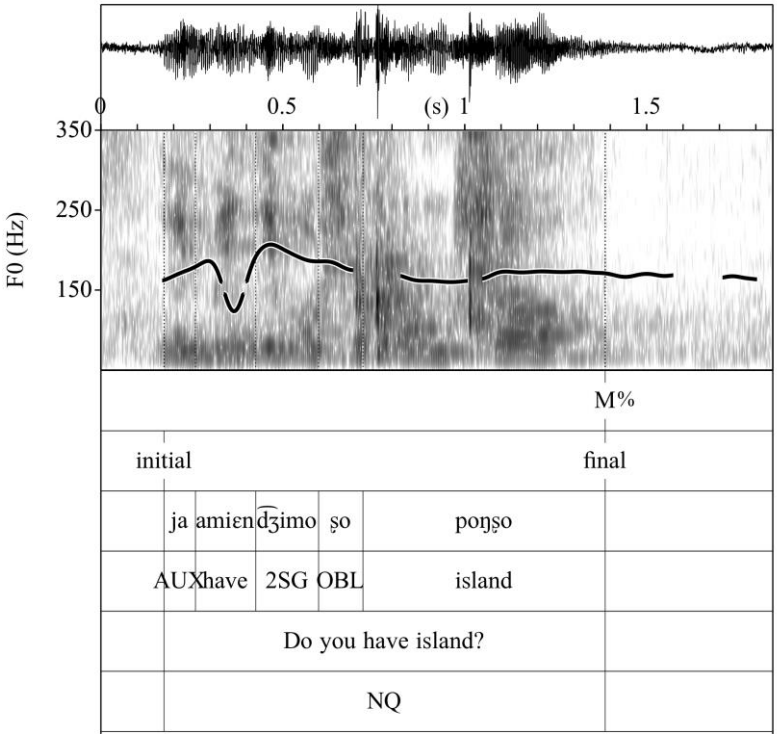


Figure 16. M boundary tone

When labeling Mandarin data, I referred to the Pan-Mandarin ToBI (M_ToBI) system (Peng, Chan, Tseng, Huang, Lee, & Beckman, 2006: 259-261), which uses H% and L% to mark high and low boundary tone, respectively. Acoustic analyses from a new study (Chuang & Fon, 2016), however, show that Mandarin NQs and SQ2s are realized with a level pitch contour, I therefore add a new tone, M%, to the tone inventory. As mentioned in Section 2.3.1.2, the two question types differ in pitch register, with SQ2s being significantly higher in pitch (labeled as ↑M%)[18] than NQs (M%).

(b) F_0 slope: there are different ways of locating an initial F_0 point. When the sentences contain intermediate pitch excursions, researchers may choose the start of an observed

[18] According to the ToBI transcription convention, an upward arrow denotes a higher pitch register.

pitch fall or rise in a sentence as an initial F_0 point. Whereas when the pitch contours are monotonic, researchers may measure F_0 height at the beginning of the sentence.

In this dissertation, F_0 slope is defined as the difference between phrase- final and initial F_0 values (O'Rourke, 2009) because in indigenous languages, speakers show variants of the same sentence (cf. Figure 14, Figure 15, and Figure 16). This makes it difficult to mark the same position of observed pitch fall or rise across sentences. In such regard, I followed O'Rourke (2009) in measuring the F_0 height at the end and beginning of the sentence to facilitate comparisons.

(c) Pitch height: pitch height functions as a discriminator of sentence types in Mandarin (NQ (M%) vs. SQ2 (↑M%), cf. Table 5), but whether pitch height serves a similar function in Yami remains unexplored so far. Including this parameter thus offers fresh insights into the phonetic correlates of Yami intonation. Following Huron & Shanahan (2013), I measured the average pitch height for each sentence.

All pitch extraction and measurements were done in Praat. F_0 measurements were time-normalized and converted to semitone (st) by implementing the ProsodyPro script (Xu, 2013) to facilitate comparison across sentences and speakers in each cohort.

3.3.2 Statistical analysis

One-way independent ANOVAs were performed to study the effect of language background on F_0 slope (between-subject design). For pitch height, I wanted to examine the effect of sentence type on pitch height (within-subject design). However, since both Yami and Mandarin datasets are non-balanced (and even non-parametric for the Yami data), to avoid statistical errors, I only reported group mean (Table 15).

Table 15. Statistical analysis

	Yami data	Mandarin data
F_0 slope	One-way independent ANOVA Main effect: language background Four levels: - **Yami-monolingual** (Reference group) - Yami-dominant bilingual - Balanced bilingual - Mandarin-dominant bilingual	One-way independent ANOVA Main effect: language background Four levels: - **Mandarin-monolingual** (Reference group) - Mandarin-dominant bilingual - Balanced bilingual - Yami-dominant bilingual
Pitch height	Group mean Five levels: - ST - NQ - SQC - SQ1 - SQ2	Group mean Five levels: - ST - NQ - SQC - SQ1 - SQ2

4.0 YAMI RESULTS

This chapter reports the results on the Yami dataset, produced by one near Yami-monolingual and three (Yami-dominant, balanced, and Mandarin-dominant) bilingual groups (37 total speakers). Five sentence types were investigated. Participants contributed a total of 1,291 sentences, and 181 of them were discarded. This included the STs elicited from the memory card game (intended targets: SQCs); the negative STs from the card-guessing task (intended targets: SQ1s and SQ2s); and the sentences that contained non-target words (light grey shading in Table 16). This yielded a total of 1,110 eligible sentences for analysis.

Table 16. Discarded Yami data

Task	Intended target	Ineligible sentence	
Memory card game	**SQC** [aŋit ɹi/ja(n)] sky PAR *'(Is that) sky?'*	ST [aŋit] sky *'(It is) river.'*	
Card-guessing	**SQ2** [koŋo aŋit ɹi/ja] what sky PAR *'This is sky!?'*	Negative ST [ta makoan sija o aŋit] to negate look like DEI, it NOM sky *'It does not look like sky.'*	
Target lexical item	Gloss	Ineligible word/phrase	Gloss
[a.ŋit]	*'sky'*	[dʒ̃i.lat]	*'lightning'*
		[ka..ɹa.wan]	*'world, universe'*
[a.jo]	*'river'*	[ɹa.ko a ɹa.non] water LIN water	*'large flows of water'*
		[ɹa.non ɖo ta.kəɪ] water LOC mountain	*'water coming from the mountains'*
[a.taʊ]	*'sea water'*	[wa.wa]	*'sea, ocean'*

Abbreviations: PAR = particle; DEI = deictic; NOM = nominative case; LIN = linker; LOC = locative case

Essentially, balanced and Mandarin-dominant bilinguals had little trouble processing all game tasks and could provide eligible tokens with ease. Eliciting statement questions (SQ1 and SQ2) from older speakers was more challenging because Yami-monolinguals and some Yami-dominant bilinguals showed difficulty capturing the subtle pragmatic difference between SQ1 and SQ2. They either said that there is no difference between the two and simply skipped SQ2s, or used a negative ST, rather than the desired statement question construction, to express their incredulity (Table 16). This resulted in an extremely small eligible SQ2 sample (n = 8) by Yami-monolinguals. The results and interpretation from the analysis of SQ2 should therefore be treated with some caution.

The following sections report the results on Yami final boundary tone, mean F_0 slope, and mean pitch height.

4.1 FINAL BOUNDARY TONE

Final boundary tones were analyzed using the combination of auditory impression of the pitch movement and visual inspection of F_0 contour on Praat. The dataset (N = 1,110) contains 276 STs, 229 NQs, 238 SQCs, 213 SQ1s, and 154 SQ2s. The frequencies and relative percentages of final boundary tone across sentence types by all participants are provided in Table 17.

Three patterns emerged. In accordance with my previous research (Lai & Gooden, 2015, 2016a), STs (90%) have a solid falling pattern, whereas SQCs (86%) take a rising intonation. A new finding from this dissertation shows that most SQ1s (68%) are realized with a terminal rise.

NQ and SQ2 intonation is less straightforward as both falling and rising patterns are dominant (light grey shading in Table 17).

Table 17. Final boundary tone across Yami sentences

Boundary tone / Sentence type	H% (final rise)	M% (level pitch contour)	L% (final fall)	N = 1,110
ST	3 (1%)	26 (9%)	**247 (90%)**	276
NQ	98 (43%)	31 (13%)	100 (44%)	229
SQC	**205 (86%)**	21 (9%)	12 (5%)	238
SQ1	**144 (68%)**	9 (4%)	60 (28%)	213
SQ2	73 (47%)	10 (7%)	72 (46%)	155

To gain a clearer picture of Yami intonation, closer examinations on NQ and the two types of statement questions (SQ1 and SQ2) were conducted. Speaker typology (four levels: Yami-monolingual, Yami-dominant bilingual, balanced bilingual, Mandarin-dominant bilingual) was included to see whether language background affects the choice of final boundary tone.

4.1.1 Yami-monolinguals

NQs (n = 38) were mostly realized with a final L tone (71%), followed by a H edge tone (21%) and a small portion of level tone (M%, 8%). SQ1s (n = 25), on the other hand, were featured with a final H tone (80%), followed by a M tone (16%) and a minor portion of L tone (4%). For SQ2s (n = 8), Yami-monolinguals favored a final rise (63%), followed by a falling pattern (25%) and then a level tone (12%).

Table 18. Yami final boundary tone by Yami-monolinguals

Boundary tone / Sentence type	H% (final rise)	M% (level pitch contour)	L% (final fall)	n
NQ	8 (21%)	3 (8%)	**30 (71%)**	38
SQ1	**20 (80%)**	4 (16%)	1 (4%)	25
SQ2	**5 (63%)**	1 (12%)	2 (25%)	8

4.1.2 Yami-dominant bilinguals

Speakers displayed wide variation in the use of final boundary tone for each sentence type, making it difficult to figure out major intonation patterns. For NQs (n = 73), although participants preferred terminal fall (48%), they also made frequent use of final rise (37%), followed by a level tone (15%). SQ1s (n = 59) showed patterns in the order of final rise (54%) > final fall (43%) > level contour (3%). A closer examination shows that, the inclination for falling NQs and rising SQ1s in fact resembles Yami-monolinguals' speech. SQ2s, on the other hand, patterned differently from those produced by Yami-monolinguals (H% > L% > M%) as Yami-dominant bilinguals selected a falling pitch contour (52%) over rising (37%) and level (11%) patterns (i.e., L% > H% > M%).

Table 19. Yami final boundary tone by Yami-dominant bilinguals

Boundary tone / Sentence type	H% (final rise)	M% (level pitch contour)	L% (final fall)	n
NQ	27 (37%)	11 (15%)	**35 (48%)**	73
SQ1	**32 (54%)**	2 (3%)	25 (43%)	59
SQ2	19 (37%)	6 (11%)	**27 (52%)**	52

4.1.3 Balanced bilinguals

Balanced bilinguals showed analogies to their Yami-dominant counterparts in two respects. First, balanced bilinguals also split falling NQs (54%) and SQ2s (61%) from rising SQ1s (58%). Second, their choice of boundary tones is not clear-cut either. As seen in Table 20, while balanced bilinguals showed a tendency to produce falling NQs, they also made frequent use of final H tone (37%). For SQ2s, despite the preference of using a final L tone (61%), the rate of using a final H tone (39%) is pretty high and non-negligible. Likewise, although most SQ1s were realized with a H tone (58%), there is frequent occurrence of final L tone (40%) as well.

Table 20. Yami final boundary tone by balanced bilinguals

Boundary tone / Sentence type	H% (final rise)	M% (level pitch contour)	L% (final fall)	n
NQ	13 (37%)	3 (9%)	**19 (54%)**	35
SQ1	**33 (58%)**	1 (2%)	23 (40%)	57
SQ2	14 (39%)	0 (0%)	**22 (61%)**	36

4.1.4 Mandarin-dominant bilinguals

Mandarin-dominant bilinguals exhibited rather different patterns. They produced a robust rising intonation in both SQ1s (94%, n = 29) and SQ2s (95%, n = 19). With regard to NQs (n = 17), unlike other groups who opted for a falling pattern, Mandarin-dominant bilinguals selected a rising intonation (59%) over level (23%) and falling (18%) patterns.

Table 21. Yami final boundary tone by Mandarin-dominant bilinguals

Boundary tone / Sentence type	H% (final rise)	M% (level pitch contour)	L% (final fall)	n
NQ	**10 (59%)**	4 (23%)	3 (18%)	17
SQ1	**27 (94%)**	1 (3%)	1 (3%)	29
SQ2	**18 (95%)**	1 (5%)	0 (0%)	19

Before proceeding to F_0 measurements, sentences containing overlapping, laughing, clear disfluency/hesitation, or background noise that would obscure pitch and contour information were eliminated. This yielded a smaller dataset containing 701 eligible sentences (Table 22).

Table 22. Overall Yami intonation patterns across speaker groups in the smaller dataset

Boundary tone / Sentence type	H% (final rise)	M% (level pitch contour)	L% (final fall)	N = 701
ST	2 (1%)	18 (10%)	**168 (89%)**	188
NQ	39 (37%)	12 (11%)	54 (52%)	105
SQC	**132 (83%)**	17 (11%)	10 (6%)	159
SQ1	**102 (68%)**	6 (4%)	43 (28%)	151
SQ2	53 (54%)	7 (7%)	38 (39%)	98

Despite a smaller sample size (N = 701), the set of sentences I conducted the acoustic analyses on (top panel in Figure 17) exhibit the same characteristics as the original dataset (N = 1,110) (bottom panel in Figure 17). That said, the results derived from acoustic analyses are reliable and representative of the general trends observed in the full dataset.

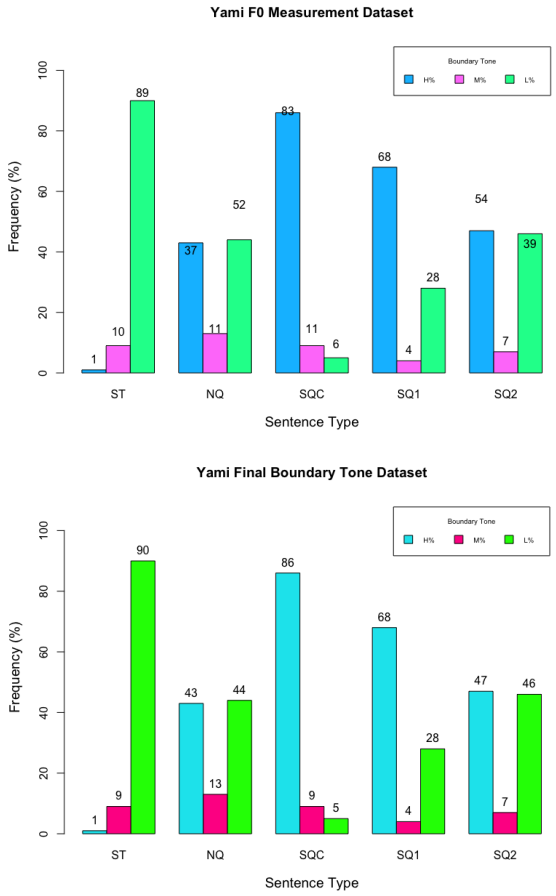


Figure 17. Distributions of final boundary tone by all speakers between two Yami datasets

4.1.5 Section summary

General intonation of Yami by each group is summarized in Table 23. Overall, speakers showed consistency in distinguishing falling STs from rising SQCs and SQ1s. NQs were mostly realized with a falling intonation, with the exception that Mandarin-dominant bilinguals preferred a rising pattern. SQ2 intonation is even murkier because, surprisingly, Mandarin-dominant bilinguals patterned with Yami-monolinguals by adopting rising intonation rather than with other two bilingual groups who favored falling intonation. A thorough analysis on F_0 slope and pitch height may help provide some clarity.

Table 23. Yami intonation by speaker typology

Speaker typology \ Sentence type		NQ	SQ1	SQ2	ST	SQC
Yami-monolingual		**L%**	**H%**	H%	**L%**	**H%**
Bilingual	Yami-dominant	L%	H%	L%	L%	H%
	Balanced	L%	H%	L%	L%	H%
	Mandarin-dominant	H%	H%	H%	L%	H%

4.2 MEAN F_0 SLOPE

F_0 slope was measured by calculating the difference between phrase- final and initial F_0 values (O'Rourke, 2009; Lai & Gooden, 2015. 2016a). The F_0 measurements were then time-normalized and converted into semitone (st) by implementing the ProsodyPro script (Xu, 2013). Results on F_0 slope are arranged by sentence type (ST, NQ, SQCs, SQ1, and SQ2). A one-way independent ANOVA was performed for each sentence type to study the effect of speaker typology on F_0 slope.

Since intonation varies widely across speakers (Jun & Fletcher, 2014: 503-505), examining all possible comparisons could likely make it too complex to gain an overall picture of Yami intonation. Working with the assumption that older speakers speech often represents a more conservative form of the language (Grinevald, 2003), I used older Yami-monolinguals' speech as the primary benchmark (except for their SQ2 intonation) to see whether and how bilingual groups patterned similar to or divergent from the traditional forms.

Although Japanese was introduced into Orchid Island between the 1920s through the 1940s, the Japanese population was limited to those who received Japanese schooling and who are now over 80 years old. Since the oldest participant in this dissertation is 69 years old, I assume the influence of Japanese to be minimal in their Yami production.

4.2.1 Statement (ST)

All groups of speakers produced a negative F_0 slope in their STs: M $_{\text{Yami-monolingual}}$ = -3.37 (st), M $_{\text{Yami-dominant bilingual}}$ = -1.68 (st), M $_{\text{Balanced bilingual}}$ = -2.12 (st), and M $_{\text{Mandarin-dominant bilingual}}$ = -1.02 (st). Results from one-way ANOVA showed a significant effect of speaker typology on slope steepness (*F(3,184) = 5.76, p < .001*). A Tukey's post-hoc test revealed significant difference between Yami-monolinguals and Yami-dominant bilinguals (*p < .01*) and between Yami-monolinguals and Mandarin-dominant bilinguals (*p < .001*), as the Yami monolinguals produced a steeper slope than other two groups. No significant difference was found between Yami monolinguals and balanced bilinguals (*p = .1*).

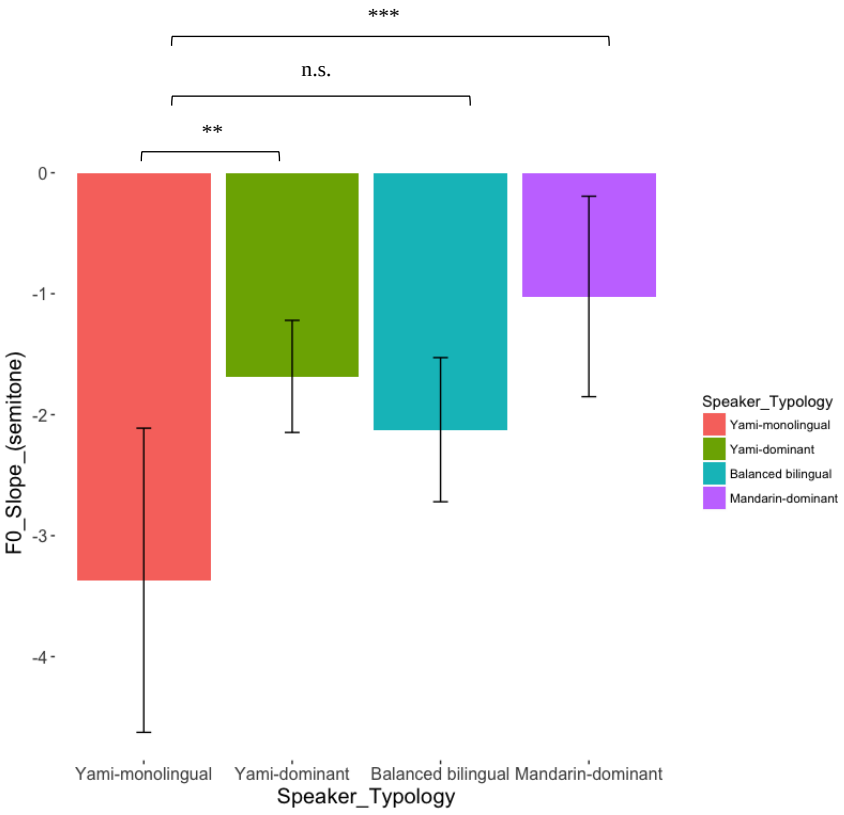


Figure 18. Yami ST intonation by speaker typology

4.2.2 Neutral question (NQ)

The four groups patterned differently in their NQs: M $_{\text{Yami-monolingual}}$ = -0.82 (st), M $_{\text{Yami-dominant bilingual}}$ = -0.01 (st), M $_{\text{Balanced bilingual}}$ = 0.2 (st), and M $_{\text{Mandarin-dominant bilingual}}$ = 2.39 (st). Results from one-way ANOVA confirmed the effect of speaker typology on slope steepness (*F(3,101) = 8.38, p < .001*). Tukey's post-hoc analysis revealed a significant difference between Yami-monolinguals and Mandarin-dominant bilinguals (*p < .001*) in that Yami monolinguals showed a shallow negative slope, whereas Mandarin dominant bilinguals a positive slope. No significant differences were found between Yami-monolinguals and Yami-dominant bilinguals (*p = 1*) and between Yami-monolinguals and balanced bilinguals (*p = .98*). Still, the three groups patterned slightly different: Yami monolinguals displayed a final fall; Yami-dominant bilinguals, a very flat contour; and balanced bilinguals, a small final rise.

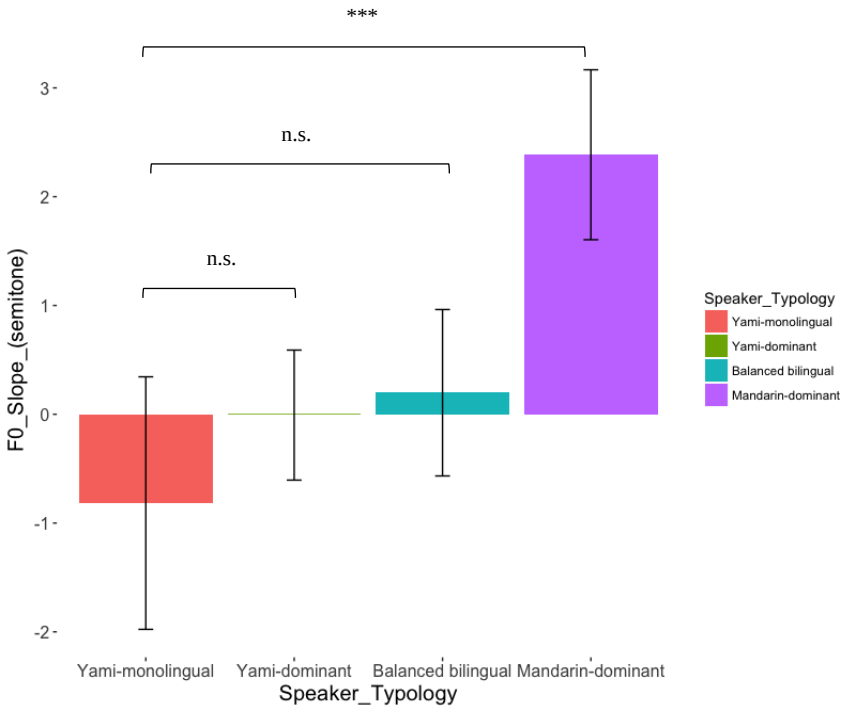


Figure 19. Yami NQ intonation by speaker typology

4.2.3 Confirmation-seeking statement question (SQC)

Speakers consistently produced a positive F_0 slope in their SQCs: M $_{\text{Yami-monolingual}}$ = 3.25 (st), M $_{\text{Yami-dominant bilingual}}$ = 1.96 (st), M $_{\text{Balanced bilingual}}$ = 3.51 (st), and M $_{\text{Mandarin-dominant bilingual}}$ = 3.78 (st). Results from one-way ANOVA showed that the effect of speaker typology on slope steepness was not significant (*F(3,155) = 2.75, p = .05*).

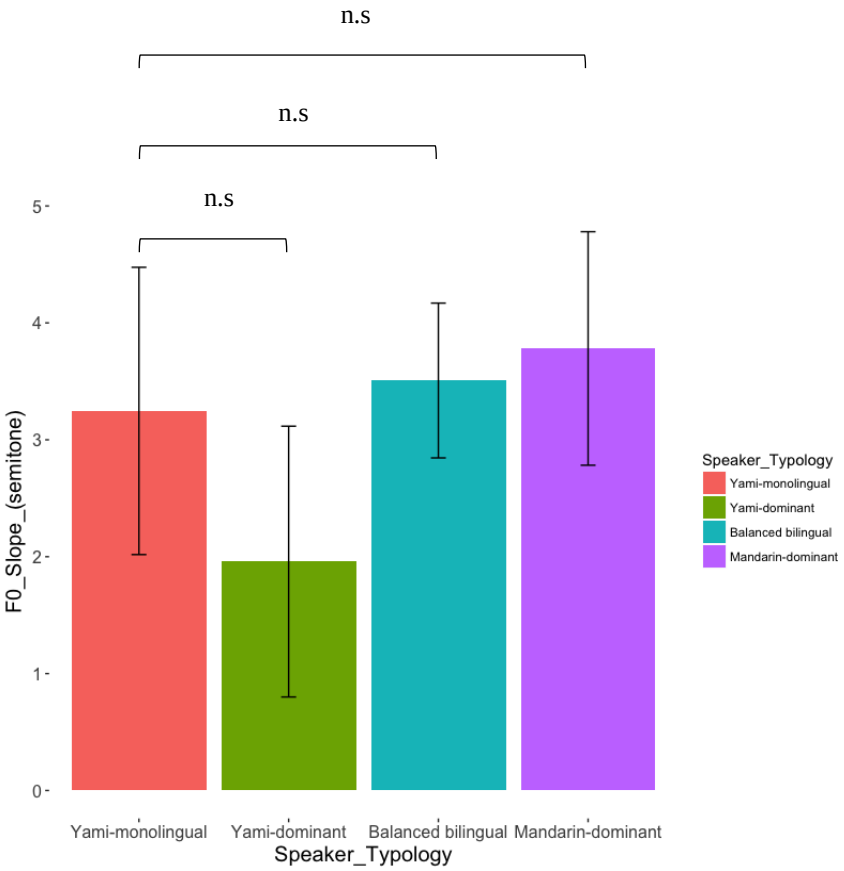


Figure 20. Yami SQC intonation by speaker typology

4.2.4 Statement question (SQ1)

Speakers reliably realized a positive F_0 slope in their SQ1s: M $_{\text{Yami-monolingual}}$ = 2.26 (st), M $_{\text{Yami-dominant bilingual}}$ = 1.35 (st), M $_{\text{Balanced-bilingual}}$ = 1.17 (st), and M $_{\text{Mandarin-dominant bilingual}}$ = 4.84 (st). Since the assumptions of normality and homogeneity of variance were not fulfilled, a non-parametric test, a Kruskal-Wallis test, was performed. The results suggested a significant effect of speaker typology on slope steepness χ^2 *(3, N=151) = 14.95, p < .01*. A Dunn post-hoc test with Bonferroni correction revealed that there was no significant difference in slope steepness between Yami monolinguals and all bilingual groups.[19]

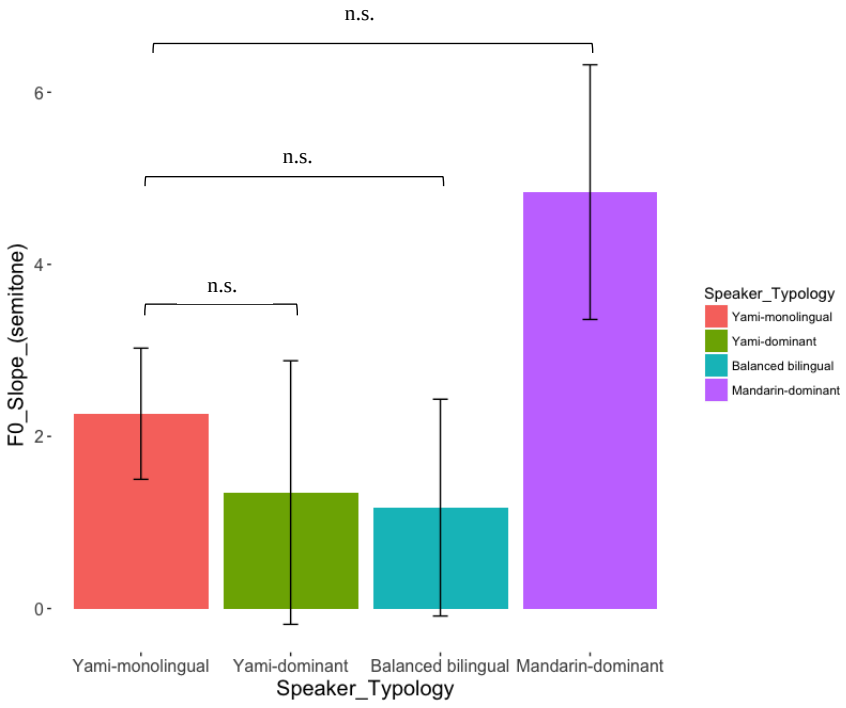


Figure 21. Yami SQ1 intonation by speaker typology

[19] In fact, significant differences were found between Mandarin-dominant bilinguals and Yami-dominant bilinguals ($p < .01$) and between Mandarin-dominant bilinguals and balanced bilinguals ($p < .001$) because Mandarin-dominant bilinguals produced much steeper slope then the other two groups. Since this dissertation focuses on the comparison and contrast between Yami-monolinguals and the three bilingual groups, the significant differences among the three bilingual groups will be saved for future study.

4.2.5 Statement question with lighter incredulity (SQ2)

Speakers varied in their slope direction: M $_{\text{Yami-monolingual}}$ = 0.36 (st), M $_{\text{Yami-dominant bilingual}}$ = -0.17 (st), M $_{\text{Balanced bilingual}}$ = -1.11 (st), and M $_{\text{Mandarin-dominant bilingual}}$ = 4.82 (st). Results from a Kruskal-Wallis test suggested a significant effect of speaker typology on steepness χ^2 *(3, N=98) = 21.77, p < .001*. As seen in Figure 22, intonation patterns spread through falling (balanced bilinguals), level (Yami-monolinguals and Yami-dominant bilinguals), and steep rising (Mandarin-dominant bilinguals) contours. A Dunn post-hoc test with Bonferroni correction showed a total of three significant differences between Mandarin-dominant bilinguals and Yami-monolinguals (*p < .05*), between Mandarin-dominant and Yami-dominant bilinguals (*p < .001*), and between Mandarin-dominant and balanced bilinguals (*p < .001*).

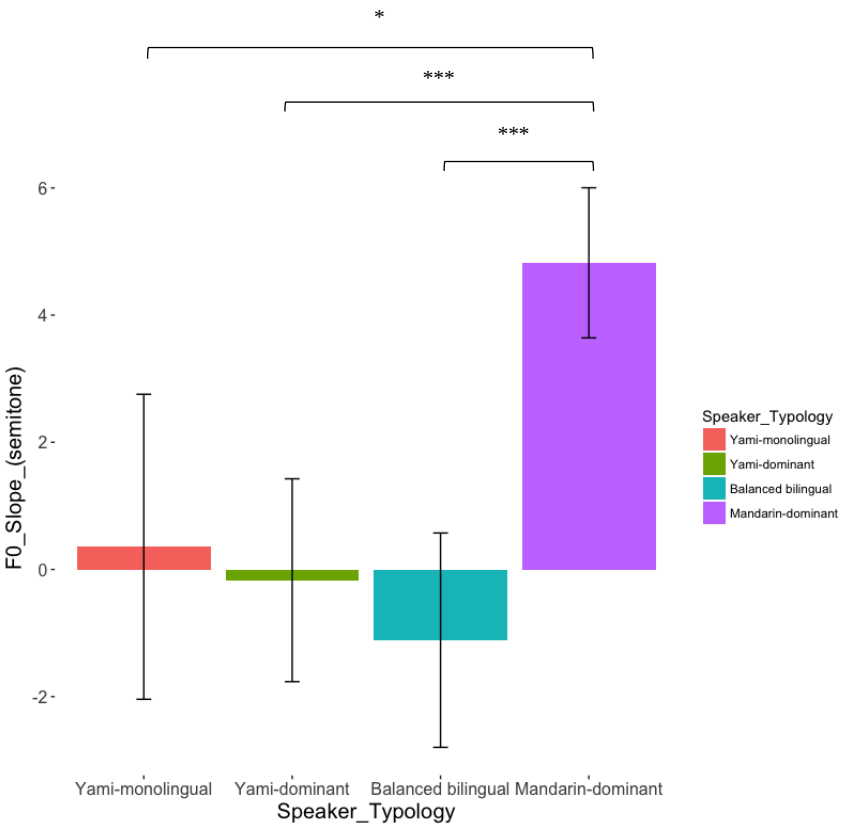


Figure 22. Yami SQ2 intonation by speaker typology

The wide variation participants showed in their SQ2s makes it very difficult to identify a clear SQ2 intonation pattern. A potential explanation for such variation is offered in Section 6.3.1.

4.2.6 Section summary

Essentially, Yami-monolinguals suggested that STs and NQs have a negative slope, which show steepness in the order of ST > NQ. In contrast, SQCs and SQ1s have a positive slope, which show steepness in the order of SQC > SQ1. Using Yami-monolinguals' speech as reference, Table 24 suggests that with decreasing proficiency in Yami, bilinguals' intonation patterns are becoming progressively different from the canonical forms. For balanced and Mandarin-dominant bilinguals, NQs are characterized by a rising intonation. Mandarin-dominant bilinguals showed a further variation by producing an extremely steep slope in their SQ1s.

Table 24. Yami F_0 slope by speaker typology[20]

	Negative slope & steepness	Positive slope & steepness
Yami-monolingual	**ST > NQ**	**SQC > SQ1**
Yami-dominant bilingual	ST > NQ	SQC > SQ1
Balanced bilingual	ST	SQC > SQ1 > NQ
Mandarin-dominant bilingual	ST	SQ1 > SQC > NQ

[20] SQ2 intonation is unclear at this point, and is hence temporarily excluded from the summary table.

4.3 MEAN PITCH HEIGHT

To get a better idea of how Yami intonation system works, mean pitch height (in semitone) for each sentence was also measured to see if Yami speakers use pitch height to signal sentence type. Note that here I "flipped" the analysis – unlike in the F_0 slope section, where I arranged the results by sentence type, in the pitch height section, I reported the results around *speaker typology* (four levels: Yami-monolingual, Yami-dominant bilingual, balanced bilingual, and Mandarin-dominant bilingual) because this method is more informative. For each group, the five sentence types (statement (ST), neutral question (NQ), confirmation-seeking question (SQC), default statement question (SQ1), and statement question with lighter incredulity (SQ2)) were acoustically classified into two broader categories: falling and rising intonation. The Yami data are non-parametric and non-balanced, so I only report the average pitch height for comparison.

4.3.1 Yami-monolinguals

Speakers distinguished falling STs and NQs from rising SQCs, SQ1s, and SQ2s. Within the falling category, STs (M = 89.75 (st)) are a bit higher in pitch than NQs (M = 88.26 (st)). Within the rising category, SQCs (M = 90.29 (st)) and SQ1s (M = 91.66 (st)) are higher in pitch than SQ2s (M = 86.85 (st)).

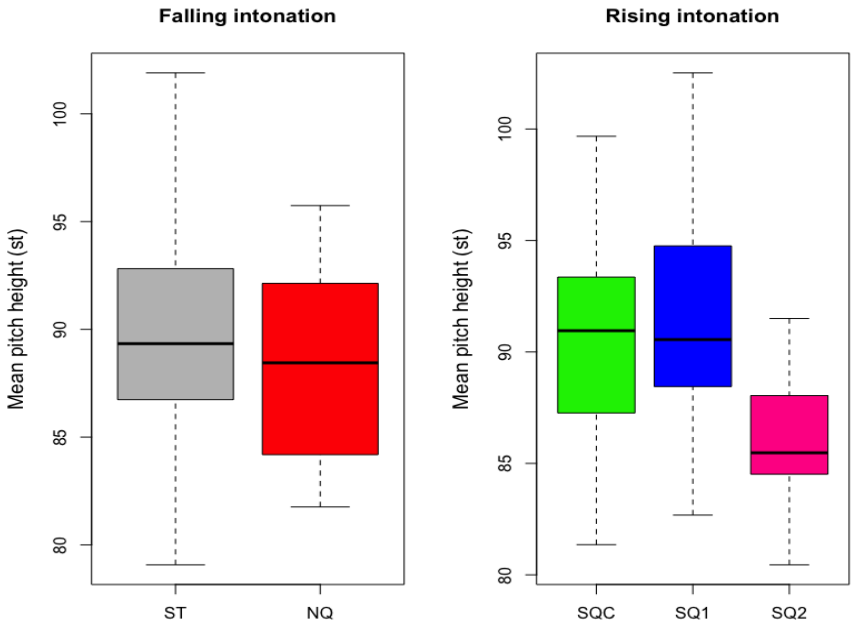


Figure 23. Yami intonation categorization and pitch height[21] by Yami-monolinguals

4.3.2 Yami-dominant bilinguals

Speakers separated falling STs, NQs, and SQ2s from rising SQCs and SQ1s. Within the falling category, SQ2s (M = 91.64 (st)) and NQs (M = 90.1 (st)) are a bit higher in pitch than STs (M = 89.5 (st)). Within the rising category, SQ1s (M = 93.2 (st)) have higher pitch than SQCs (M = 90.71 (st)).

[21] Note that the line drawn across each box represents the *median* of the sample, rather than the group mean.

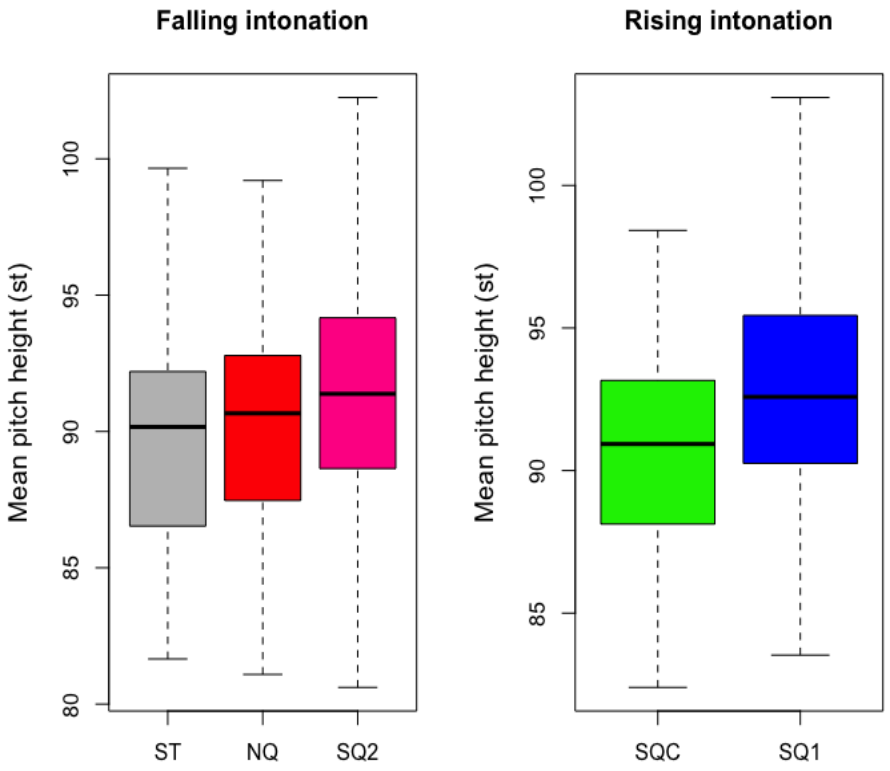


Figure 24. Yami intonation categorization and pitch height by Yami-dominant bilinguals

4.3.3 Balanced bilinguals

Speakers differentiated falling STs and SQ2s from rising NQs, SQCs, and SQ1s. Within the falling category, SQ2s (M = 93.51 (st)) and STs (M = 93.09 (st)) are similar in pitch height. Within the rising category, SQ1s (M = 94.56 (st)) are highest in pitch, followed by SQCs (M= 92.96 (st)) and NQs (M = 92.51 (st)) (Figure 25).

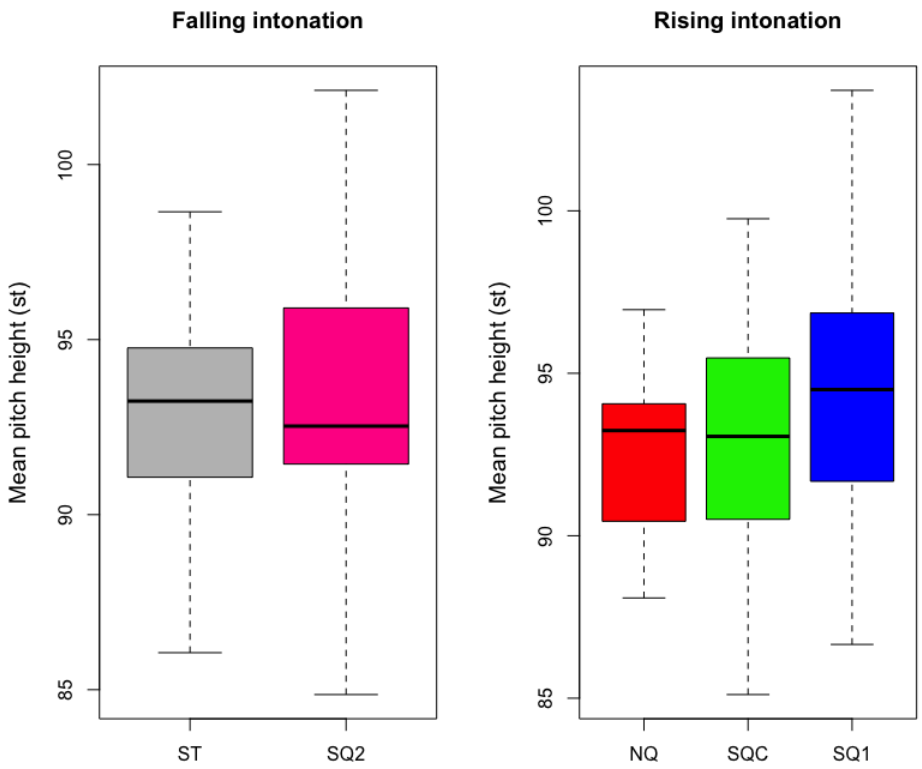


Figure 25. Yami intonation categorization and mean pitch height by balanced bilinguals

4.3.4 Mandarin-dominant bilinguals

Speakers split their sentences into falling STs (M = 89.61 (st)) versus rising NQs, SQCs, SQ1s, and SQ2s. Within the rising category, SQ2s have the highest pitch (M = 93.52 (st)), followed by SQ1s (M = 91.86 (st)), and then NQs (M = 89.75 (st)) and SQCs (M = 89.18 (st)).

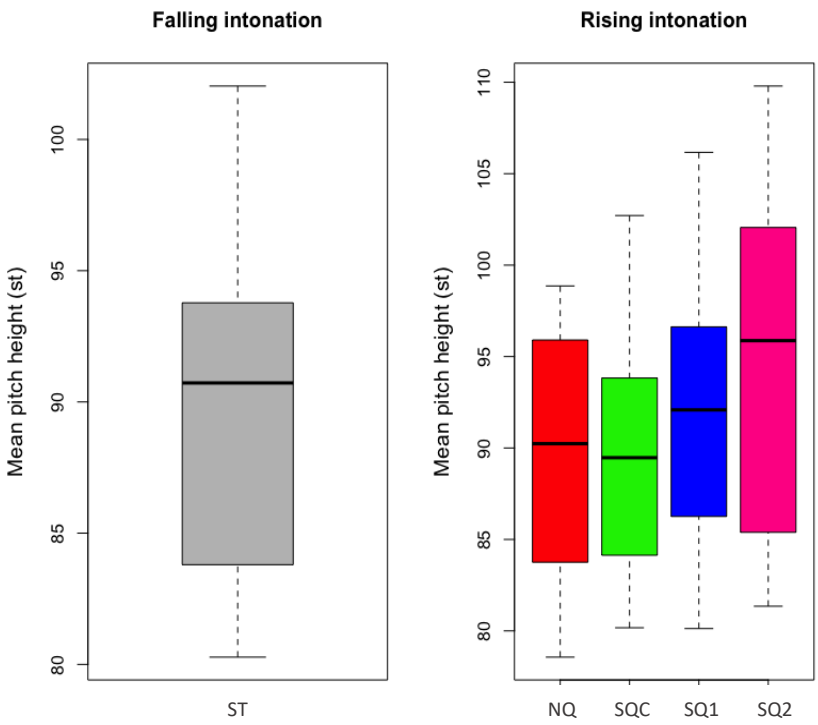


Figure 26. Yami intonation categorization and mean pitch height by Mandarin-dominant bilinguals

4.3.5 Section summary

In the falling intonation category, Yami-monolinguals produced STs and NQs, both of which share similar pitch height. In the rising intonation category, Yami-monolinguals produced SQ1s and SQCs, with SQ1s being higher in pitch than SQCs. Balanced and Mandarin-dominant bilinguals produced their SQ1s, SQCs and NQs with a rising intonation, with SQ1s being higher in pitch than SQCs and NQs (Table 25). SQ2s were excluded from the summary table because it is hard to determine its intonation category (see Section 4.2.5).

Table 25. Yami pitch height by speaker typology

	Falling intonation & Pitch height	Rising intonation & Pitch height
Yami-monolingual	**ST ≈ NQ**	**SQ1 > SQC**
Yami-dominant bilingual	ST ≈ NQ	SQ1 > SQC
Balanced bilingual	ST	SQ1 > SQC, NQ
Mandarin-dominant bilingual	ST	SQ1 > SQC, NQ

4.3.6 Chapter summary

To sum up, participants produced a robust falling intonation in their Yami statements (STs) and a rising intonation in their confirmation-seeking questions (SQCs) and default statement questions (SQ1s). However, they showed variation in their neutral questions (NQs). The reference group, Yami-monolinguals, produced a falling contour in their NQs. The group mean for F_0 slope showed that Yami-dominant and balanced bilinguals made frequent use of both final low and high tone, thus yielding a flat pitch contour. Mandarin-dominant bilinguals constantly used a rising intonation to encode their questions despite the pragmatic differences across the subtypes. When pitch height is included, we see that SQ1s are higher in pitch, labeled as ↑H%. Table 26 summarizes the results on the three acoustic parameters for each sentence type by different speaker typologies.

Table 26. Summary of three acoustic parameters for Yami sentences

		Speaker typology			
Sentence type	Acoustic parameter	YM	YD	BB	MD
ST	Final boundary tone	L%	L%	L%	L%
	F_0 slope (st)	-3.37	-1.68	-2.12	-1.02
	Pitch height (st)	89.75	89.5	93.09	89.61
NQ	Final boundary tone	L%	L% & H%	L% & H%	H%
	F_0 slope (st)	-0.82	-0.01	0.2	2.39
	Pitch height (st)	88.26	90.1	92.51	89.75
SQC	Final boundary tone	H%	H%	H%	H%
	F_0 slope (st)	3.25	1.96	3.51	3.78
	Pitch height (st)	90.29	90.71	92.96	89.18
SQ1	Final boundary tone	↑H%	↑H%	↑H%	↑H%
	F_0 slope (st)	2.26	1.35	1.17	4.84
	Pitch height (st)	91.66	93.2	94.56	91.86

5.0 MANDARIN RESULTS

This chapter reports the results on the Mandarin dataset, produced by one Mandarin-monolingual and three (Mandarin-dominant, balanced, and Yami-dominant) bilingual groups (39 total speakers). To avoid confusion, different varieties of Mandarin were specified as necessary: the Mandarin spoken in mainland Taiwan was referred to as "mainstream Mandarin", and the Mandarin spoken on Orchid Island was referred to as "Orchid Island Mandarin".

Five sentence types were investigated as with the Yami dataset. Participants contributed a total of 1,306 sentences. 453 ineligible sentences were discarded, including the STs elicited from the memory card game (intended targets: SQCs); the negative STs or exclamation sentences[22] from the card-guessing task (intended targets: SQ1s and SQ2s); and those involving non-target words (Table 27). This yielded a total of 853 eligible sentences. To facilitate cross-linguistic comparison with Yami, the same parameters, final boundary tone, mean F_0 slope, and mean pitch height, were examined.

[22] Exclamation sentences were formed by attaching the particle *-oh* [oʔ] to the end of STs to express strong disbelief or disagreement.

Table 27. Discarded Mandarin data

Task	Intended target	Ineligible sentence	
Memory card game	**SQC** [ʂɿ^{4} tʰjɛn^{1}kʰʊŋ^{1} ma^{0}] COP verb, to be sky PAR *'Is (that) sky?'*	ST [ʂɿ^{4} tʰjɛn^{1}kʰʊŋ^{1}] COP verb, to be sky *'(It) is sky.'*	
Card-guessing	**SQ1** and **SQ2** [ʐɣ^{4} ʂɿ^{4} tʰjɛn^{1}kʰʊŋ^{1}] DEI, this COP verb, to be sky *'This is sky!?'*	Negative ST [ʐɣ^{4} bu^{2} ʂɿ^{4} tʰjɛn^{1}kʰʊŋ^{1}] DEI, this negator COP verb, to be sky *'This is not sky.'* or Exclamation sentence: ST-*oh* [ʐɣ^{4} ʂɿ^{4} tʰjɛn^{1}kʰʊŋ^{1} oʔ^{0}] DEI, this COP verb, to be sky EXCL *'It can't be sky.'*	
Target lexical item	Gloss	Ineligible word/phrase	Gloss
[xɤ^{2}.ljoʊ^{2}]	'river'	[ɕi^{1}.ljoʊ^{2}]	'brook'
[xaɪ^{3}.ʂweɪ^{3}]	'sea water'	[ɕjɛn^{2}.ʂweɪ^{3}]	'salt water'

Abbreviations: COP = copula; PAR = particle; DEI = deictic; EXCL = exclamation

5.1 FINAL BOUNDARY TONE

The dataset (N = 853) contains 179 STs, 160 NQs, 162 SQCs, 182 SQ1s, and 170 SQ2s. The frequencies and relative percentages of final boundary tone across sentence types are provided in Table 28. Across all groups, participants distinguished falling STs (67%) from level-contour NQs (89%), SQ1s (58%) and SQ2s (58%). SQC intonation is less clear as participants showed similar percentages using either a final M (58%) or L (41%) tone (light grey shading in Table 28).

Table 28. Final boundary tone across Mandarin sentences

Boundary tone / Sentence type	H% (final rise)	M% (level pitch contour)	L% (final fall)	N = 853
ST	6 (3%)	54 (30%)	**119 (67%)**	179
NQ	4 (2%)	**142 (89%)**	14 (9%)	160
SQC	1 (1%)	94 (58%)	67 (41%)	162
SQ1	53 (29%)	**106 (58%)**	23 (13%)	182
SQ2	16 (9%)	**106 (63%)**	48 (28%)	170

To better understand the Mandarin spoken by Yami speakers, closer examinations of the final boundary tone were performed. Here, I chose Mandarin-monolinguals as the reference group because they acquired Mandarin first and had lived in Taiwan for several years before reaching adolescence. Their speech would thus better approximate mainstream Mandarin. To see whether different groups of speakers progressively diverge from the Mandarin-monolingual reference group, the results are arranged in the order of Mandarin-monolingual and then Mandarin-dominant, balanced, and Yami-dominant bilinguals. Since both Yami and Mandarin speakers use falling intonation to encode STs, particular emphasis was directed toward the other four sentence types.

5.1.1 Mandarin-monolinguals

In line with previous discussion (Chuang *et al.*, 2007; Chuang & Fon, 2016), Mandarin-monolinguals adopted a level intonation in more than 80% of their NQs (84%, n = 32) and SQ2s (80%, n = 41). SQ1 (n = 48) intonation is less evident because both rising (52%) and level (44%) contours are significant (light grey shading in Table 29). SQC (n = 41) intonation has not been

widely studied before. Participants from this study selected a level intonation (60%) over a falling pattern (40%).

Table 29. Mandarin final boundary tone by Mandarin-monolinguals

Boundary tone / Utterance type	H% (final rise)	M% (level pitch contour)	L% (final fall)	n
NQ	1 (3%)	**27 (84%)**	4 (13%)	32
SQC	0 (0%)	**27 (60%)**	18 (40%)	45
SQ1	25 (52%)	21 (44%)	2 (4%)	48
SQ2	2 (5%)	**33 (80%)**	6 (15%)	41

5.1.2 Mandarin-dominant bilinguals

Mandarin-dominant bilinguals largely resembled Mandarin-monolinguals' speech, but differed in their SQ1 (n = 40) intonation. Instead of opting for pitch rise, Mandarin-dominant bilinguals favored a level contour (65%). This makes their SQ1 and SQ2 intonation more similar. Even so, we can still locate a subtle difference between the two: SQ1s were realized in the order of M% > H% > L%, while SQ2s were produced in the order of M% > L% > H% (Table 30).

Table 30. Mandarin final boundary tone by Mandarin-dominant bilinguals

Boundary tone / Utterance type	H% (final rise)	M% (level pitch contour)	L% (final fall)	n
NQ	2 (6%)	**25 (81%)**	4 (13%)	31
SQC	0 (0%)	**18 (67%)**	9 (33%)	27
SQ1	12 (30%)	**26 (65%)**	2 (5%)	40
SQ2	5 (13%)	**24 (65%)**	8 (22%)	37

5.1.3 Balanced bilinguals

Balanced bilinguals patterned with their Mandarin-dominant bilingual counterparts by utilizing level intonation in all question types. Once again, they produced a level intonation in most of their SQ1s and erased the SQ1-SQ2 distinction (Table 31).

Table 31. Mandarin final boundary tone by balanced bilinguals

Boundary tone / Utterance type	H% (final rise)	M% (level pitch contour)	L% (final fall)	n
NQ	0 (0%)	**39 (95%)**	2 (5%)	41
SQC	0 (0%)	**31 (63%)**	18 (37%)	49
SQ1	9 (17%)	**36 (68%)**	8 (15%)	53
SQ2	5 (11%)	**23 (53%)**	16 (36%)	44

5.1.4 Yami-dominant bilinguals

Yami-dominant bilinguals further deviated from Mandarin-monolinguals' speech in two aspects. First, they adopted a level (56%), rather than a rising intonation (17%), in their SQ1s. Second, Mandarin-monolinguals presented level intonation in their SQCs, but Yami-dominant bilinguals preferred a falling pattern (54%) over a level one (44%).

Table 32. Final boundary tone by Yami-dominant bilinguals

Boundary tone / Utterance type	H% (final rise)	M% (level pitch contour)	L% (final fall)	n
NQ	1 (2%)	**51 (91%)**	4 (7%)	56
SQC	1 (2%)	18 (44%)	22 (54%)	41
SQ1	7 (17%)	**23 (56%)**	11 (27%)	41
SQ2	4 (8%)	**26 (54%)**	18 (38%)	48

Before proceeding to F_0 measurements, files containing overlapping, laughing, clear disfluency/hesitation, or background noise were eliminated. This yielded a smaller dataset containing 731 eligible sentences (Table 33).

Table 33. Overall pitch trends across Mandarin sentence types

Boundary tone / Sentence type	H% (final rise)	M% (level pitch contour)	L% (final fall)	N = 731
ST	6 (4%)	49 (31%)	**102 (65%)**	157
NQ	3 (2%)	**132 (89%)**	13 (9%)	148
SQC	1 (1%)	88 (59%)	59 (40%)	148
SQ1	40 (27%)	**93 (62%)**	16 (11%)	149
SQ2	12 (9%)	**83 (65%)**	34 (26%)	129

Once again, the dataset (N = 731) I performed the acoustic analyses on (top panel in Figure 27) displays the same characteristics as the full dataset (N = 853) (bottom panel in Figure 27).

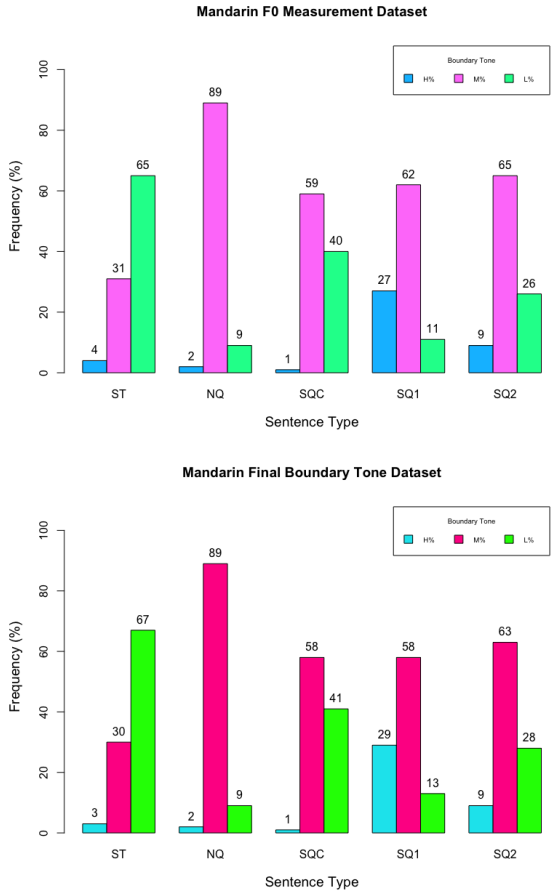


Figure 27. Distributions of final boundary tone by all speakers between two Mandarin datasets

5.1.5 Section summary

Overall, speakers showed resemblance by using a level tone (M%) in their NQs and SQ2s, but presented variation in their SQ1 and SQC intonation (light grey shading in Table 34). Referring to Mandarin-monolinguals' speech, SQ1s and SQ2s were characterized by rising and level contours respectively. The SQ1-SQ2 distinction, however, becomes less discernible in all bilingual groups' speech as both questions were realized with a level contour (red cell in Table 34), and no clear SQC intonation was specified as before. Results from this dissertation show that most participants chose a level pattern, while Yami-dominant bilinguals favored a falling contour.

Table 34. Mandarin intonation by speaker typology

Speaker typology \ Sentence type		NQ	SQC	SQ1	SQ2	ST
Mandarin-monolingual		**M%**	**M%**	**H%**	**M%**	**L%**
Bilingual	Mandarin-dominant	M%	M%	M%	M%	L%
	Balanced	M%	M%	M%	M%	L%
	Yami-dominant	M%	L%	M%	M%	L%

5.2 MEAN F_0 SLOPE

As with the Yami data, F_0 slope was measured by calculating the difference phrase- final and initial F_0 values, and these were time-normalized and converted into semitone (st). Results are arranged by sentence type (ST, NQ, SQC, SQ1, and SQ2). A one-way independent ANOVA was performed for each type to study the effect of speaker typology on F_0 slope.

5.2.1 Statement (ST)

All groups of speakers produced a negative slope in their STs: M $_{\text{Mandarin-monolingual}}$ = -3.86 (st), M $_{\text{Mandarin-dominant bilingual}}$ = -4.85 (st), M $_{\text{Balanced bilingual}}$ = -5.9 (st), and M $_{\text{Yami-dominant bilingual}}$ = -5.3 (st). Although Mandarin-monolinguals produced a less sharper slope, the effect of speaker typology on steepness was not significant (*F(3, 153) = 1.9, p = .13*).

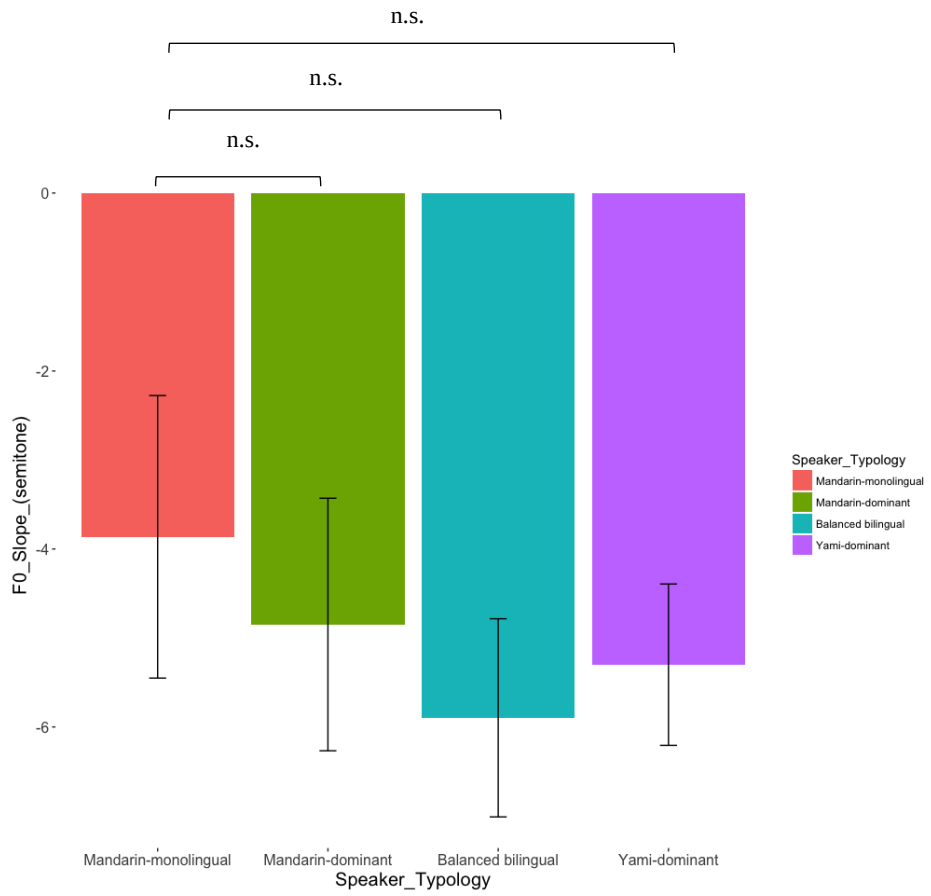


Figure 28. ST intonation in Orchid Island Mandarin

5.2.2 Neutral question (NQ)

Speakers produced a negative slope in their NQs: M $_{\text{Mandarin-monolingual}}$ = -0.98 (st), M $_{\text{Mandarin-dominant}}$

bilingual = -1.94 (st), M Balanced bilingual = -0.99 (st), and M Yami-dominant bilingual = -1.32 (st). No significant effect of speaker typology on steepness was found (*F(3, 144) = 1.09, p < .36*). Yet, unlike STs that are characterized by a sharp negative slope, NQs spread between level and shallow falling contours.

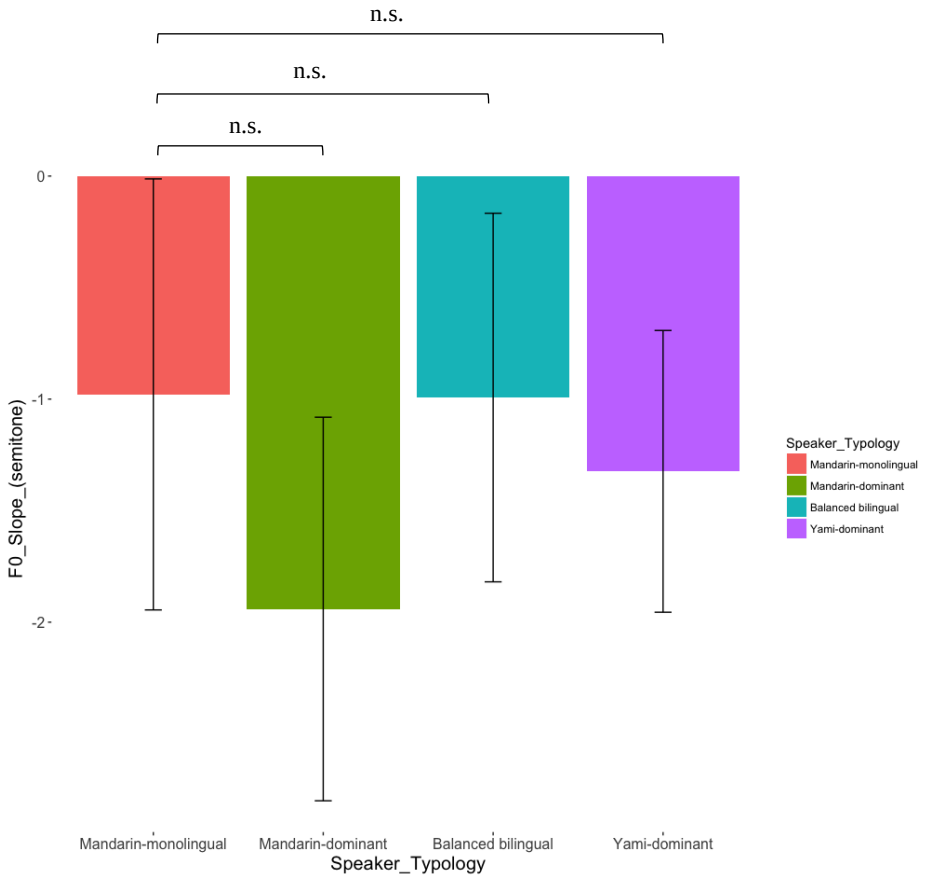


Figure 29. NQ intonation in Orchid Island Mandarin

5.2.3 Confirmation-seeking statement question (SQC)

Participants produced a negative slope in their SQCs: M Mandarin-monolingual = -3.92 (st), M Mandarin-dominant bilingual = -3.8 (st), M Balanced bilingual = -3.79 (st), and M Yami-dominant bilingual = -3.88 (st). No significant effect of speaker typology was found (*F(3, 144) = 0.02, p = 1*).

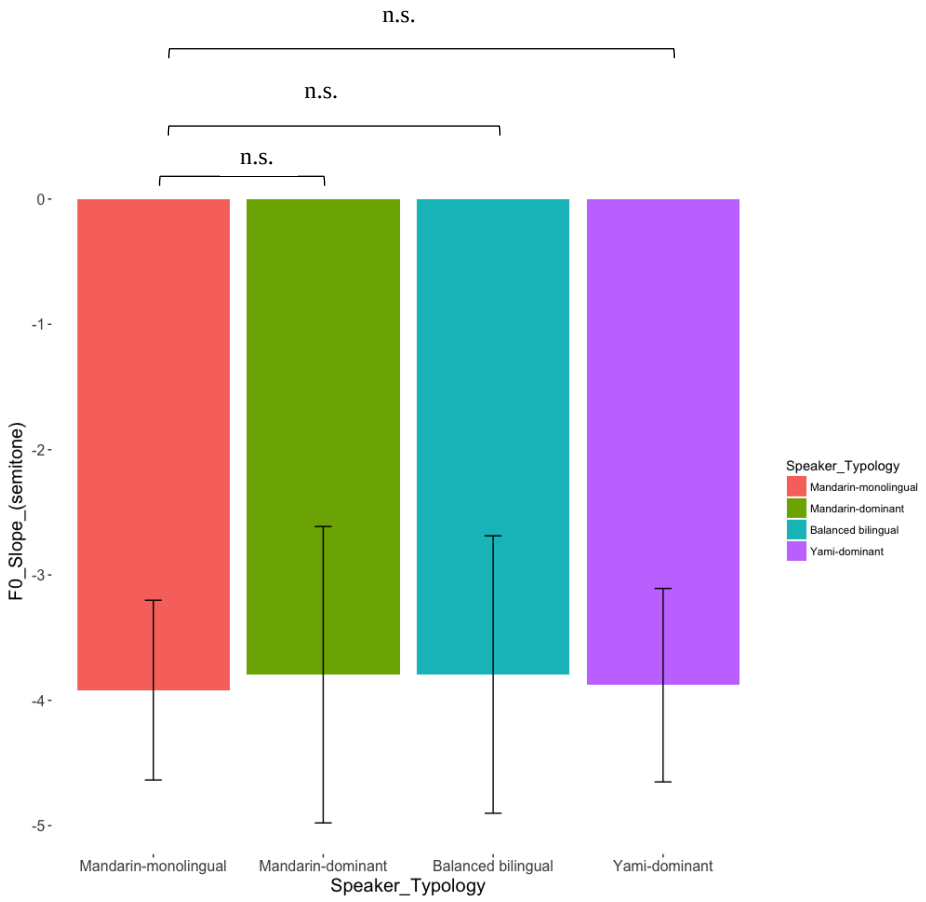


Figure 30. SQC intonation in Orchid Island Mandarin

5.2.4 Statement question (SQ1)

Participants showed variation in their SQ1 intonation. Mandarin-monolinguals used a positive slope ($M_{\text{Mandarin-monolingual}}$ = 1.59 (st)), whereas other groups showed a negative slope: $M_{\text{Mandarin-dominant bilingual}}$ = -1.2 (st), $M_{\text{Balanced bilingual}}$ = -1.43 (st), and $M_{\text{Yami-dominant bilingual}}$ = -2.01 (st). Results from a one-way ANOVA suggested significant effect of speaker typology on F_0 slope ($F(3, 145) = 7.16$, $p < .001$). A post-hoc Tukey test suggested significant differences between Mandarin-monolinguals compared to Mandarin-dominant bilinguals ($p < .05$), balanced bilinguals ($p < .01$),

and Yami-dominant bilinguals ($p < .001$) (Figure 31).

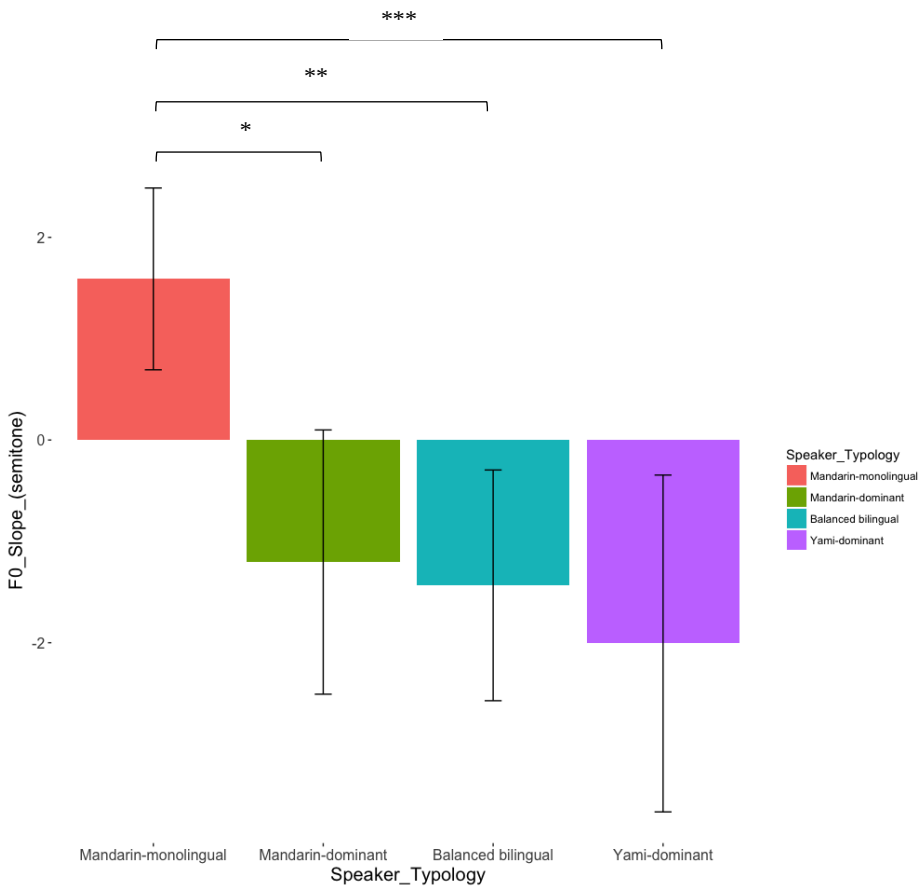


Figure 31. SQ1 intonation in Orchid Island Mandarin

5.2.5 Statement question with lighter incredulity (SQ2)

Participants produced a negative F_0 slope in their SQ2s: $M_{\text{Mandarin-monolingual}}$ = -1.43 (st), $M_{\text{Mandarin-dominant bilingual}}$ = -2.18 (st), $M_{\text{Balanced bilingual}}$ = -2.71 (st), and $M_{\text{Yami-dominant bilingual}}$ = -2.46 (st). No significant effect of speaker typology on steepness was found ($F(3,125)= 0.95$, $p = .42$).

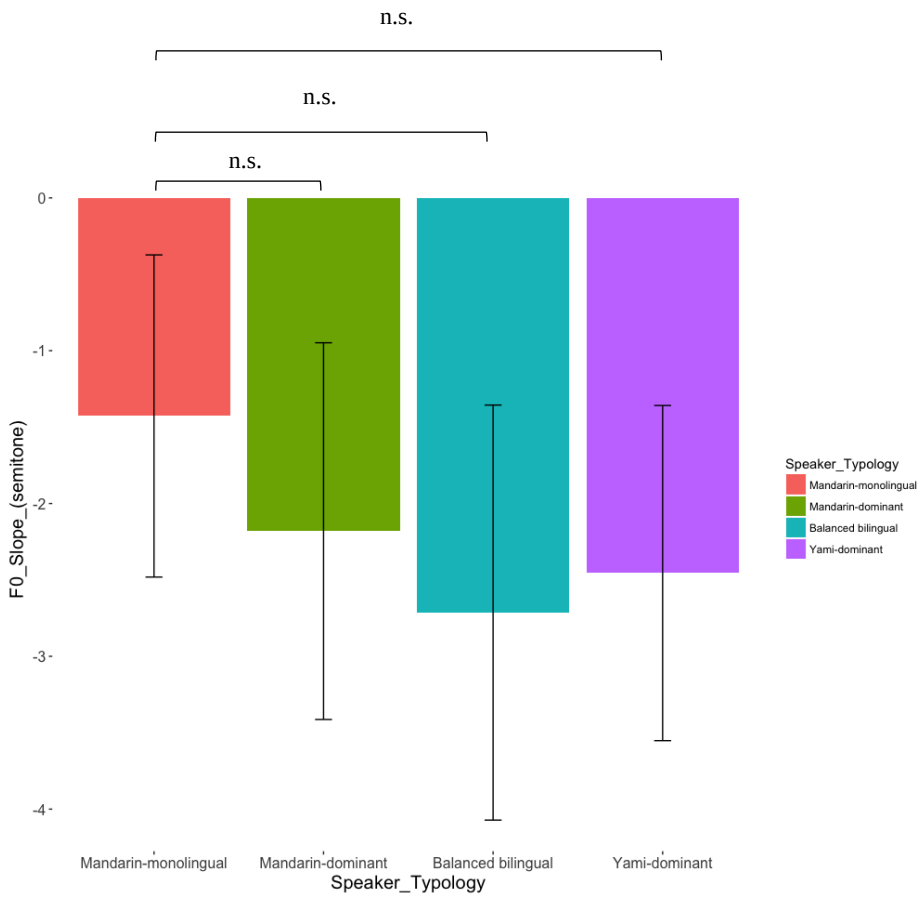


Figure 32. SQ2 intonation in Orchid Island Mandarin

5.2.6 Section summary

Referring to Mandarin-monolinguals' speech, STs, NQs, SQCs, and SQ2s were produced with a negative F_0 slope, whereas SQ1s were realized with a positive slope. A two-way contrast between rising and falling intonation category, however, is not able to adequately capture the differences within the falling intonation category. To illustrate, in Mandarin, STs (Figure 28) and SQCs (Figure 30) were realized with a steep falling contour (F_0 slope < -3 (st)), while NQs (Figure 29) and SQ2s (Figure 32) were realized with a level ~ shallow falling contour. Following Colantoni and Gurlekian (2004), who treated steep and shallow falling contours as different prosodic

categories, I argue that a new level category is needed to enhance our understanding of how Mandarin intonation system operates.

Therefore, I argue that Mandarin-monolinguals make a three-way distinction in their speech. STs and SQCs have a steep negative slope and share similar steepness. SQ1s, in contrast, have a positive slope. NQs and SQ2s have a flat ~ shallow falling contour, which show steepness in the order of SQ2 > NQ. Slope direction and steepness can be generalized in Table 35. Other bilingual groups only made a two-way – steep falling vs. level distinction. They grouped their STs and SQCs into the falling category, with STs showing greater steepness.

Another difference lies in bilinguals' SQ1 intonation. Mandarin-dominant and balanced bilinguals grouped their SQ1s into the level category, which are shallower than their SQ2s but similar in steepness to their NQs. Yami-dominant bilinguals patterned differently by having steeper slope in their SQ1s and SQ2s than in their NQs.

Table 35. Mandarin F_0 slope by speaker typology

	Steep falling contour (mean slope < -3 (st))	Level contour	Rising contour
Mandarin-monolingual	**ST** ≈ SQC	**SQ2 > NQ**	**SQ1**
Mandarin-dominant bilingual	ST > SQC	SQ2 > SQ1, NQ	
Balanced bilingual	ST > SQC	SQ2 > SQ1, NQ	
Yami-dominant bilingual	ST > SQC	SQ2, SQ1 > NQ	

5.3 MEAN PITCH HEIGHT

Results on pitch height (in semitone) are arranged by speaker typology (four levels: Mandarin-monolingual, Mandarin-dominant bilingual, balanced bilingual, and Yami-dominant bilingual). Within each group, the five sentence types (ST, NQ, SQC, SQ1, and SQ2) were classified into

falling, level, and as necessary, rising intonation categories. Since the data are non-balanced, I only report the average pitch height for comparison.

5.3.1 Mandarin-monolinguals

Participants exhibited a three-way distinction. Within the falling category, STs (M = 89.23 (st)) and SQCs (M = 89.72 (st)) are similar in pitch height. Within the level category, SQ2s (M = 96.23 (st)) are markedly higher in pitch than NQs (M = 87.59 (st)). SQ1s form a separate rising category, featured with extremely high pitch (M = 97.17 (st)).

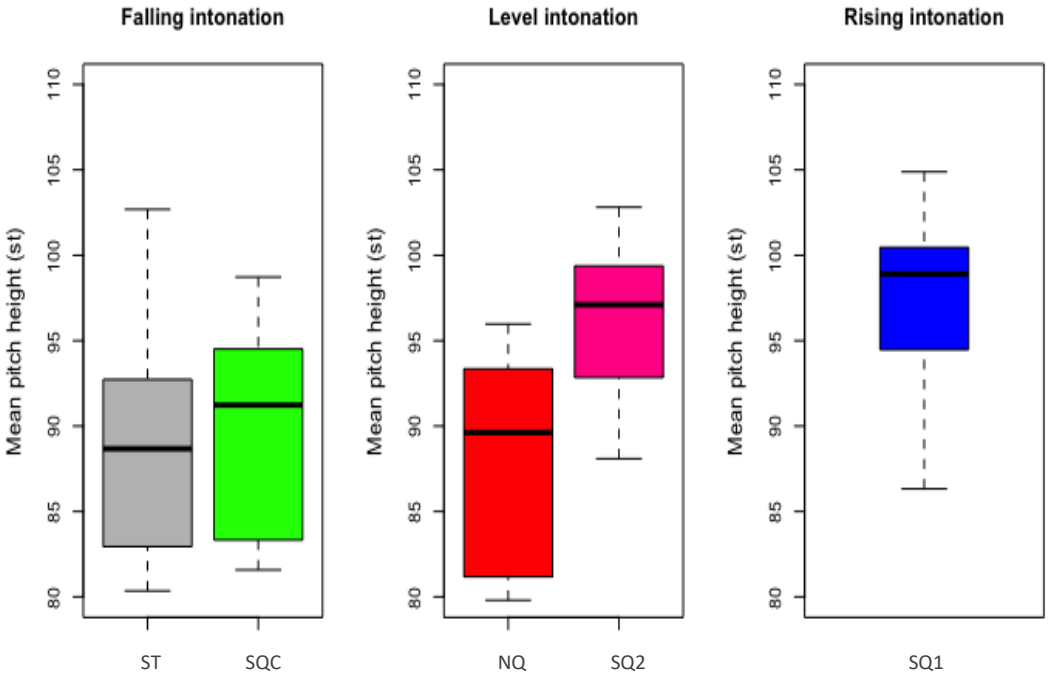


Figure 33. Intonation categorization of Orchid Island Mandarin by Mandarin-monolinguals

5.3.2 Mandarin-dominant bilinguals

Participants had a two-way split, falling and level. Within the falling category, SQCs (M = 92.04 (st)) are slightly higher in pitch than STs (M = 90.31 (st)). Within the level category, SQ1s (M= 98.36 (st)) and SQ2s (M = 95.62 (st)) are strikingly higher in pitch than NQs (M = 88.42 (st)).

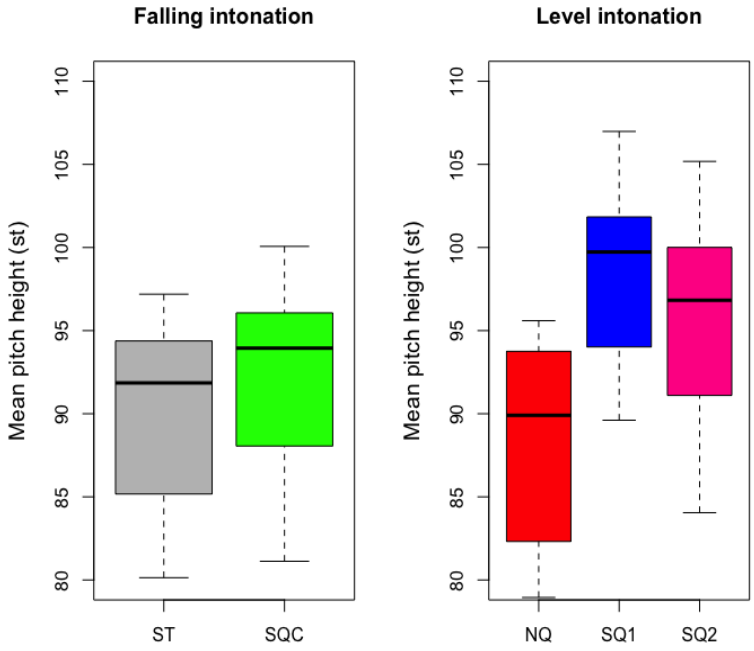


Figure 34. Intonation categorization of Orchid Island Mandarin by Mandarin-dominant bilinguals

5.3.3 Balanced bilinguals

Balanced bilinguals also classified their sentences into falling and level groups. Within the falling category, STs (M = 93.9 (st)) and SQCs (M = 93.75 (st)) are similar in pitch height. Within the level category, SQ1s (M = 98.71 (st)) and SQ2s (M = 97.32 (st)) are higher in pitch than NQs (M = 93.34 (st)).

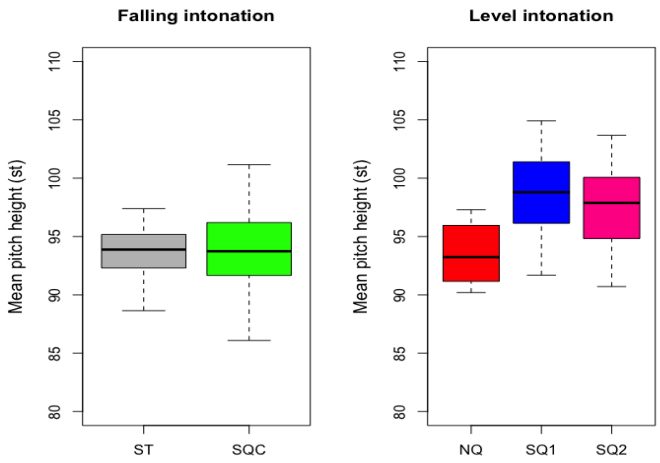


Figure 35. Intonation categorization of Orchid Island Mandarin by balanced bilinguals

5.3.4 Yami-dominant bilinguals

Yami-dominant bilinguals also displayed a two-way distinction. Within the falling category, STs (M = 91.17 (st)) are a bit higher than SQCs (M = 89.59 (st)). Within the level category, SQ1s (M = 96.4 (st)) and SQ2s (M = 95.99 (st)) are higher in pitch than NQs (M = 89.49 (st)).

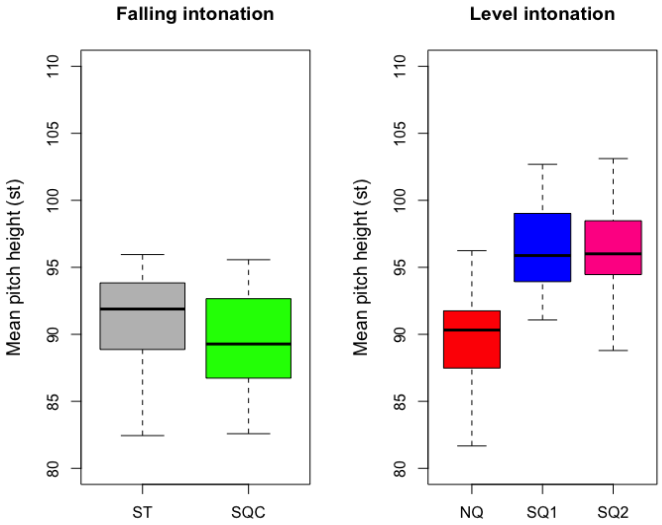


Figure 36. Intonation categorization of Orchid Island Mandarin by Yami-dominant bilinguals

5.3.5 Section summary

Mandarin-monolinguals grouped STs and SQCs into the falling intonation category, both of which share similar pitch height. SQ2s and NQs are grouped into the level category, with SQ2s being higher in pitch. SQ1s form a separate rising category, characterized by extremely high pitch. The three bilingual groups patterned differently by grouping their SQ1s, SQ2s, and NQs into the level category, within which SQ1s and SQ2s are strikingly higher in pitch than NQs. Note, however, within the falling category, varied patterns were observed. For Mandarin-dominant bilinguals, SQCs have higher pitch than STs; for balanced bilinguals, both are equal in pitch height; and for Yami-dominant bilinguals, STs are realized with higher pitch than SQCs (see Table 36). A potential explanation for such variation is offered in Section 6.2.1.

Table 36. Mandarin pitch height by speaker typology

	Falling intonation	Level intonation	Rising intonation
Mandarin-monolingual	ST ≈ SQC	SQ2 > NQ	SQ1
Mandarin-dominant bilingual	SQC > ST	SQ1 ≈ SQ2 > NQ	
Balanced bilingual	ST ≈ SQC	SQ1 ≈ SQ2 > NQ	
Yami-dominant bilingual	ST > SQC	SQ1 ≈ SQ2 > NQ	

5.3.6 Chapter summary

To sum up, across all groups, participants produced a solid falling intonation in their Mandarin STs and a level intonation in their NQs and SQ2s. SQCs and SQ1s call for more attention. Perceptually, SQCs appear to have a level pitch, but acoustically, they were realized with a negative F_0 slope, i.e., falling contour. The reference group, Mandarin-monolinguals, produced a rising intonation in their SQ1s, which is different from all other bilingual groups, who produced a

level pitch contour in the same question type. When pitch height is included, we see that SQ1s and SQ2s are higher in pitch, labeled as ↑H% and ↑M% respectively. Table 37 summarizes the results on the three acoustic parameters for each sentence type by different speaker typologies.

Table 37. Summary of three acoustic parameters for Mandarin sentences

		Speaker typology			
Sentence type	Acoustic parameter	MM	MD	BB	YD
ST	Final boundary tone	L%	L%	L%	L%
	F_0 slope (st)	-3.86	-4.85	-5.9	-5.3
	Pitch height (st)	89.23	90.31	93.9	91.17
NQ	Final boundary tone	M%	M%	M%	M%
	F_0 slope (st)	-0.98	-1.94	-0.99	-1.32
	Pitch height (st)	87.59	88.42	93.34	89.49
SQC	Final boundary tone	M%	M%	M%	L% & M%
	F_0 slope (st)	-3.92	-3.8	-3.79	-3.88
	Pitch height (st)	89.72	92.04	93.75	89.59
SQ1	Final boundary tone	↑H%	↑M%	↑M%	↑M%
	F_0 slope (st)	1.59	-1.2	-1.43	-2.01
	Pitch height (st)	97.17	98.36	98.71	96.4
SQ2	Final boundary tone	↑M%	↑M%	↑M%	↑M%
	F_0 slope (st)	-1.43	-2.18	-2.71	-2.46
	Pitch height (st)	96.23	95.62	97.32	95.99

6.0 DISCUSSION

This chapter is organized in three sections. Sections 6.1 and 6.2 summarize the findings on Yami and Orchid Island Mandarin intonations. In Section 6.3, I examine bilingual intonation patterns to identify potential contact-induced variation and suggest a future stage of the evolution of Yami and Orchid Island Mandarin intonations.

6.1 YAMI INTONATION: GENERAL DISCUSSION

Five sentence types were examined in this dissertation: statement (ST), neutral question (NQ), confirmation-seeking statement question (SQC), default statement question (SQ1), and statement question with a lighter degree of incredulity (SQ2). Prior to this dissertation, we only knew that Yami STs and WHQs are featured with a falling intonation (L edge tone), while YES/NO questions are typified by a rising pattern (H%) (Lai & Gooden, 2015, 2016a). However, YES/NO question is a broad term covering various subtypes (NQ, SQC, SQ1, SQ2, etc.) to fulfill speakers' communicative intentions. Merely looking at YES/NO questions as a broad category may conceal potential interaction between pragmatics, syntax, and intonation. To advance our understating of Yami YES/NO questions, a more fine-grained analysis is thus necessary.

6.1.1 Yami sentence type and intonation

As we saw in Sections 4.1 and 4.2, across all groups, STs are featured with a negative slope, while SQCs and SQ1s are primarily characterized with a positive one. NQ and SQ2 intonation is less straightforward, which calls for an explanation.

6.1.1.1 Yami NQ intonation

Participants displayed both inter- and intra-group variation in their NQs (Table 38). Results show that the Yami-monolingual reference group predominantly adopted a final L tone and employed a shallow falling pitch contour (M = -0.82 (st)) in their NQs.

Both Yami-dominant and balanced bilinguals displayed wide variation in the choice of final boundary tone. Although approximately half of the sentences end low in pitch, there are also significant proportions of sentences (up to 40% in each group) ending with a final rise. This leads to flat pitch contours in Yami-dominant bilingual (M = -0.01 (st)) and balanced bilinguals' (M = 0.2 (st)) NQs, which can barely be interpreted as having an authentic falling or rising pattern. Other than the variability in using a final L or H tone, it is worth noting that the two bilingual groups seem to adopt a Mandarin-like M% pattern into their Yami speech (13% for Yami-dominant bilinguals and 9% for balanced bilinguals). Based on the results from both acoustic (group means in F_0 slope) and auditory (final boundary tone) analyses, it is possible that Yami-dominant and balanced bilinguals' are in an incipient stage of integrating a level tone into their Yami NQ intonation. If this variation becomes stronger, we may need to add a new final level tone (M%) into the Yami intonation inventory.

Mandarin-dominant bilinguals showed a salient deviation from other groups by using a rising NQ intonation (M = 2.39 (st)). Based on the fact that Yami-monolinguals opted to end their NQs with a terminal fall, I argue that canonical Yami NQs would likely be signified by a falling pattern.

Table 38. Yami NQ intonation by speaker typology (N = 701)

Speaker typology \ Boundary tone		H% (final rise)	M% (level pitch contour)	L% (final fall)	Mean slope (st)	n
Yami-monolingual		2 (12%)	0 (0%)	**14 (88%)**	-0.82	16
Bilinguals	Yami-dominant	14 (38%)	5 (13%)	18 (49%)	-0.01	37
	Balanced	13 (37%)	3 (9%)	19 (54%)	0.2	35
	Mandarin-dominant	10 (59%)	4 (23%)	3 (18%)	2.39	17

6.1.1.2 Yami SQ2 intonation

SQ2 intonation is even trickier because, as mentioned in Section 4.0 , most Yami-monolinguals and some Yami-dominant bilinguals seemed to confuse SQ1 and SQ2. This is supported by the fact that Yami-monolinguals opted to produce a SQ1-like rising intonation in their SQ2s (light grey shading in Table 39).

Yami-dominant bilinguals, on the other hand, made frequent use of both rising and falling patterns in their SQ2s. The two-peak pattern was, in fact, also observed in their SQ1s (darker shading in Table 39). This makes it very difficult to draw strong conclusion about SQ2 intonation based on these older fluent speakers' data.

Table 39. Yami statement question intonation by older fluent speakers

Speaker typology \ Boundary tone		H% (final rise)	M% (level pitch contour)	L% (final fall)	Mean slope (st)	n
Yami-monolingual	SQ1	**15 (88%)**	2 (12%)	0 (0%)	2.26	24
	SQ2	**4 (57%)**	1 (14%)	2 (29%)	0.36	7
Yami-dominant bilingual	SQ1	26 (55%)	2 (4%)	19 (41%)	1.35	47
	SQ2	17 (47%)	5 (14%)	14 (39%)	-0.17	36

Even though balanced and Mandarin-dominant bilinguals could provide intended SQ2 targets, their SQ2 intonation differed markedly: falling intonation (M = -1.11 (st)) for balanced bilinguals and steep rising pattern (M = 4.82 (st)) for Mandarin-dominant bilinguals (Table 40).

It could be that older speakers had difficulty with the task or it could quite possibly be that in fact, there is ***no*** SQ2 in Yami. The reason balanced and Mandarin-dominant bilinguals could distinguish between SQ1 and SQ2 is because they map Mandarin phono-syntactic pattern, where SQ1 and SQ2 are contrastive, onto a Yami substrate.

Table 40. Yami SQ2 intonation by speaker typology

Speaker typology \ Boundary tone		H% (final rise)	M% (level pitch contour)	L% (final fall)	Mean slope (st)	n
Yami-monolingual		4 (57%)	1 (14%)	2 (29%)	0.36	7
Bilinguals	Yami-dominant	17 (47%)	5 (14%)	14 (39%)	-0.17	36
	Balanced	14 (39%)	0 (0%)	22 (61%)	-1.11	36
	Mandarin-dominant	18 (95%)	1 (5%)	0 (0%)	4.82	19

6.1.2 Interplay between F_0 slope and pitch height in Yami

The acoustic analyses further reveal a sophisticated interplay between F_0 slope and pitch height. For Yami-monolingual and Yami-dominant bilingual groups, sentences are grouped into falling

and rising categories according to the overall F_0 pattern. Within the falling category, STs and NQs are similar in pitch height but differ in slope steepness (ST > NQ). For the rising category, slope steepness varies inversely with pitch height: SQCs have a steeper slope but are lower in pitch, whereas SQ1s have a shallower slope but are higher in pitch (Figure 37).

	Falling category	Rising category
Slope steepness	ST > NQ	SQC > SQ1
Pitch height	ST ≈ NQ	SQ1 > SQC

Figure 37. Interplay between F_0 slope and pitch height by Yami monolinguals and Yami-dominant bilinguals

Taking the two dimensions together, the overall pitch trends are schematized in Figure 38.

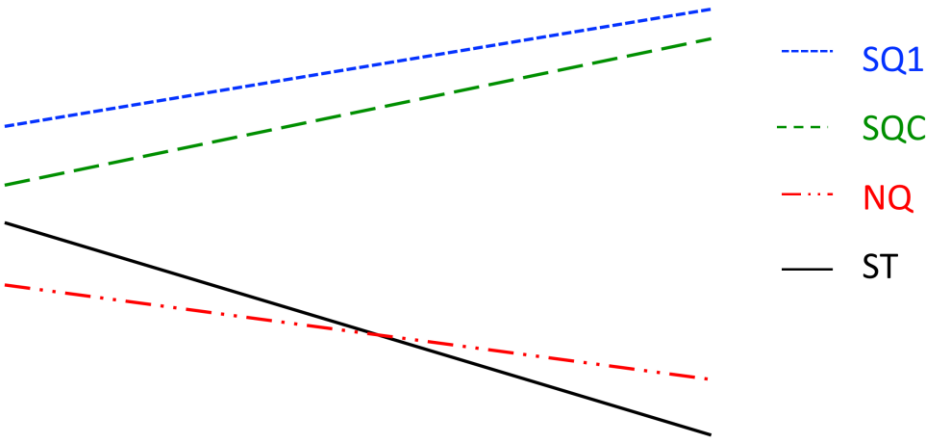


Figure 38. Yami intonation by Yami monolinguals and Yami-dominant bilinguals

Although Mandarin-dominant bilinguals categorized the sentences differently, they also displayed some interplay between F_0 slope and pitch height. As appears in Figure 39, SQ1s

stand out in steepness and height. NQs and SQCs are close in pitch height but differ in slope steepness (SQC > NQ).

	Rising category				
Slope steepness	SQ1	>	SQC	>	NQ
Pitch height	SQ1	>	NQ	≈	SQC

Figure 39. Interplay between F_0 slope and pitch height by Mandarin-dominant bilinguals

Mandarin-dominant bilinguals' intonation patterns are schematized in Figure 40.

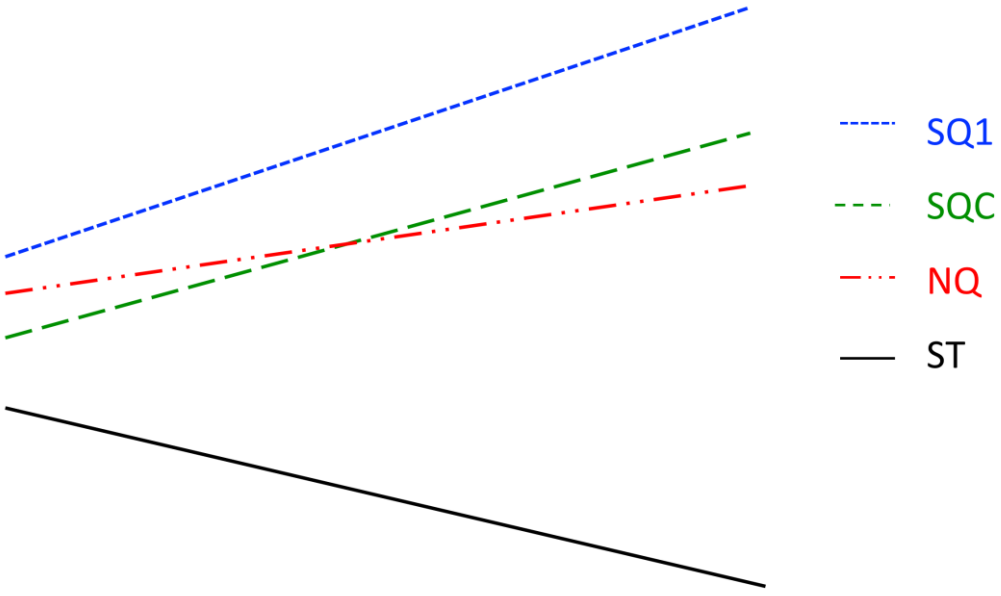


Figure 40. Yami intonation by Mandarin-dominant bilinguals

6.2 ORCHID ISLAND MANDARIN: GENERAL DISCUSSION

To reiterate, in order to avoid confusion, the Mandarin spoken in mainland Taiwan is referred to as mainstream Mandarin; the Mandarin spoken on Orchid Island is referred to as Orchid Island Mandarin. In cases where I did not specify the variety of Mandarin, then "Mandarin" stands for a separate language in opposition to Yami.

Mainstream Mandarin speakers make a three-way distinction in pitch contour: steep falling STs, level NQs and SQ2s, and rising SQ1s (Chuang *et al.*, 2007; Chuang & Fon, 2016). Orchid Island Mandarin, however, may be subject to localized influences due in part to geographic isolation of the community, typological distance between Yami (stress language) and Mandarin (tone language), and the local linguistic ecology. Therefore, I conducted a thorough acoustic analysis to see whether/how Yami intonation has diffused through Orchid Island Mandarin.

6.2.1 Sentence type and intonation in Orchid Island Mandarin

Orchid islanders patterned with mainstream Mandarin speakers in two aspects. First, STs are primarily produced with a falling intonation. Second, while both NQs and SQ2s are featured with a flat pitch contour, SQ2s are notably higher in pitch (↑M%) than NQs (M%). Despite these similarities, Orchid islanders presented two issues that need to be addressed. First, they adopted a high-level contour (↑M%), rather than a high-rising pattern (↑H%), in their SQ1s. Second, no clear pattern was found for their SQCs as both level and falling patterns are significant (Table 41). I suggest some explanations below.

Table 41. Mandarin intonation by mainland Taiwanese and Orchid islanders

	Mainstream Mandarin	Orchid Island Mandarin
ST	L%	L%
NQ	M%	M%
SQC	Unexplored	M% (58%) ~ L% (41%)
SQ1	↑H%	↑M%
SQ2	↑M%	↑M%

6.2.1.1 Mandarin SQC intonation

Mandarin confirmation-seeking questions (SQCs) have not received much discussion in previous literature, presumably because SQCs share a similar syntactic frame with NQs (both are marked with the particle *-ma*), thus masking the SQC-NQ distinction in natural speech. Results from a combined analysis of auditory impression and visual inspection of F_0 contour from this dissertation indicate that most Orchid islanders tended to converge their NQs and SQCs by adopting a level intonation (light grey shading in Table 42). The Yami-dominant group behaved differently. They strongly favored a level intonation in their NQ but spanned between level and falling patterns in their SQCs (darker shading in Table 42).

Table 42. NQ and SQC intonation in Orchid Island Mandarin (N = 731)

Speaker typology \ Boundary tone		H% (final rise)	M% (level pitch contour)	L% (final fall)	n
Mandarin-monolingual	NQ	1 (3%)	25 (84%)	4 (13%)	30
	SQC	0 (0%)	26 (62%)	16 (38%)	42
Mandarin-dominant	NQ	1 (3%)	25 (84%)	4 (13%)	30
	SQC	0 (0%)	15 (63%)	9 (37%)	24
Balanced	NQ	0 (0%)	32 (97%)	1 (3%)	33
	SQC	0 (0%)	29 (64%)	16 (36%)	45
Yami-dominant	NQ	1 (2%)	50 (91%)	4 (7%)	55
	SQC	1 (2%)	18 (49%)	18 (49%)	37

The acoustic analysis provides some evidence for this. Overall, except for the Mandarin-dominant bilingual group, SQCs and NQs are very similar in pitch height (light grey shading in Table 43). In terms of pitch change, even though SQCs have a steeper slope (blue shading in Table 43) than NQs, the difference in steepness was not easily captured, even with careful auditory analysis. A more salient difference in fact lies in speaking rate. Auditorily, SQCs are slower than NQs, and the slower rate seems to be correlated with speakers' uncertainty about the answer (Lai & Gooden, 2015). Speaking rate, in turn, may have effects on F_0 declination as read speech has steeper and more frequent declination than spontaneous speech (Lieberman, Katz, Jongman, Zimmerman, & Miller, 1985; Laan, 1997; Yuan & Liberman, 2014). This provides a potential explanation for why the slower SQCs (similar to read speech) had steeper declination than faster NQs (similar to spontaneous speech). This makes it challenging to recognize a clear SQC intonation. It could be that there is ***no*** authentic SQC in Mandarin. Alternatively, it could be that Mandarin SQC is signaled by other acoustic parameters such as speaking rate. Future analysis would help clarify the issue.

Table 43. NQ and SQC intonation in Orchid Island Mandarin

Speaker typology \ Boundary tone		Mean slope (semitone)	Mean pitch height (semitone)	n
Mandarin-monolingual	NQ	-0.98	87.59	30
	SQC	-3.92	89.72	42
Mandarin-dominant	NQ	-1.94	88.42	30
	SQC	-3.8	92.04	24
Balanced	NQ	-0.99	93.34	33
	SQC	-3.79	93.75	45
Yami-dominant	NQ	-1.32	89.49	55
	SQC	-3.88	89.59	37

6.2.1.2 SQ1 intonation in Orchid Island Mandarin

Mainstream Mandarin speakers employ a high-rising SQ1 intonation, which was reproduced by younger ethnically Yami, linguistically Mandarin-monolinguals. Other bilingual groups utilized a high-level contour to encode their SQ1s. This finding is surprising and it is hard to consider this a direct intonational borrowing from Yami because Yami SQ1s also take a high-rising pattern.

A closer look at statement questions reveals that only the reference group – ethnically Yami, linguistically Mandarin-monolinguals – preserved the mainstream Mandarin-like SQ1 (high-rising)-SQ2 (high-level) contrast (blue and green shades in Table 44), other groups seemed to blur this distinction. This is particularly true for Yami-dominant bilinguals, whose SQ1s and SQ2s are very close in F_0 slope and pitch height (light grey shading in Table 44). The lack of SQ1-SQ2 contrast could arguably arise from Yami influence, as I argued in Section 6.1.1.2 that Yami does not have a reliable distinction between SQ1 and SQ2.

Table 44. Statement question intonation in Orchid Island Mandarin

Speaker typology		Boundary tone	Mean slope (semitone)	Mean pitch height (semitone)	Intonation pattern	n
Mandarin-monolingual		SQ1	1.59	97.17	↑H%	41
		SQ2	-1.43	96.23	↑M%	34
Bilingual	Mandarin-dominant	SQ1	-1.2	98.36	↑M%	28
		SQ2	-2.18	95.62	↑M%	23
	Balanced	SQ1	-1.43	98.71	↑M%	44
		SQ2	-2.71	97.32	↑M%	34
	Yami-dominant	SQ1	-2.01	96.4	↑M%	36
		SQ2	-2.46	95.99	↑M%	38

Note: Keep in mind that mainstream Mandarin intonation is categorized into steep falling (mean slope < -3) STs, level ~ shallow falling NQs and SQ2s, and rising SQ1s. ↑ represents a higher pitch register.

6.2.2 Interplay between F_0 slope and pitch height in Orchid Island Mandarin

The Mandarin-monolingual reference group did not show interplay between F_0 slope and pitch height in their speech. Leaving out the less clearly-defined SQCs, Mandarin-monolinguals' Mandarin sentences fall into sharp falling (ST), rising (SQ1), and level (SQ2 and NQ) categories. Within the level category, SQ2s are higher in pitch and have a steeper slope than NQs (Figure 41).

Intonation category	Sharp falling	Level ~ shallow falling			Rising
Slope steepness	ST	SQ2	>	NQ	SQ1
Height	ST	SQ2	>	NQ	SQ1

Figure 41. Interplay between F_0 slope and pitch height by Mandarin-monolinguals

Mandarin-monolinguals' intonation patterns are schematized in Figure 42.

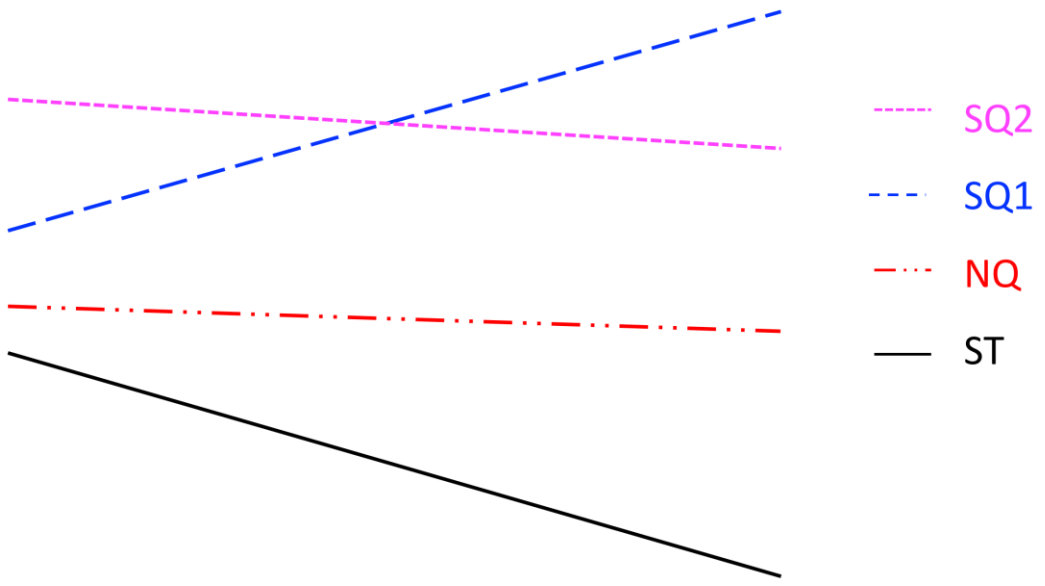


Figure 42. Orchid Island Mandarin intonation by Mandarin-monolinguals

The interplay is also missing in Yami-dominant bilinguals' speech. Within the level category, SQ1s and SQ2s patterned similarly to form a single statement question (SQ) category. NQs, on the other hand, pattern independently and are typified by a shallower slope and lower pitch height (Figure 43).

Intonation category	Sharp falling	Level ~ shallow falling
Slope steepness	ST	SQ1 ≈ SQ2 > NQ
Pitch height	ST	SQ1 ≈ SQ2 > NQ

Figure 43. Interplay between F_0 slope and pitch height by Yami-dominant bilinguals

Yami-dominant bilinguals' intonation patterns are schematized in Figure 44.

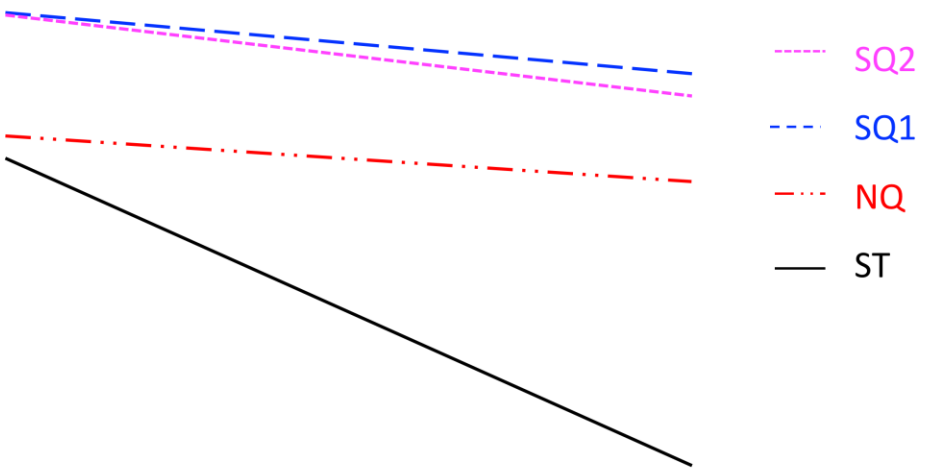


Figure 44. Orchid Island Mandarin intonation by Yami-dominant bilinguals

Mandarin-dominant and balanced bilingual groups seemed to exhibit some interplay in their SQs: SQ1s and SQ2s are similar in pitch height, but SQ2s show a steeper slope. NQs form an individual group as they are noticeably lower in pitch height (Figure 45).

Intonation category	Sharp falling	Level ~ shallow falling
Slope steepness	ST	SQ2 > SQ1 ≈ NQ
Pitch height	ST	SQ1 ≈ SQ2 > NQ

Figure 45. Interplay between F_0 slope and pitch height by Mandarin-dominant and balanced bilinguals

Mandarin-dominant and balanced bilinguals' intonation patterns are schematized in Figure 46.

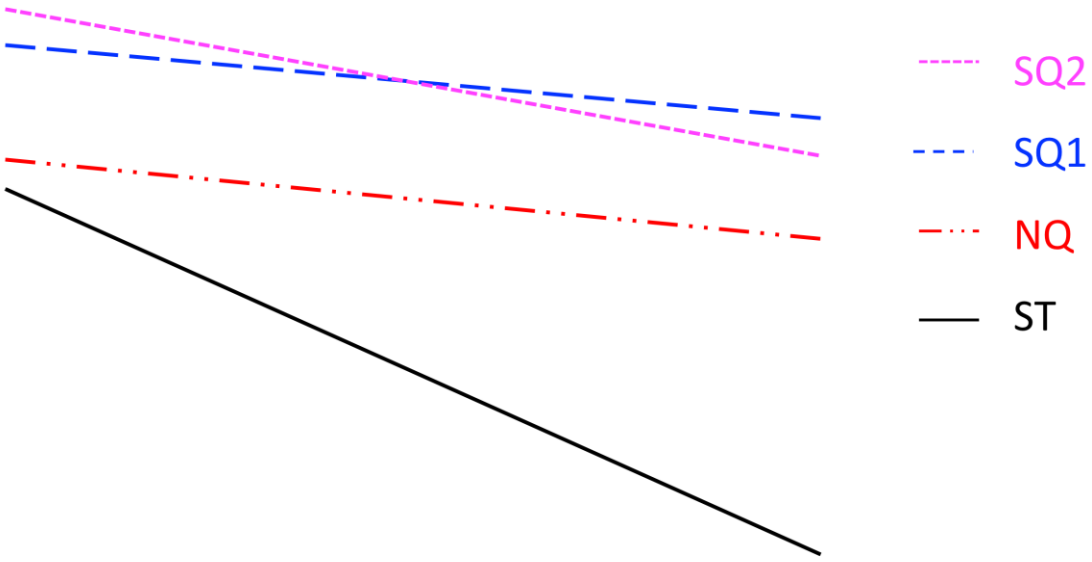


Figure 46. Orchid Island Mandarin intonation by Mandarin-dominant and balanced bilinguals

6.3 PROSODIC CHANGE IN BILINGUAL SPEECH

This section addresses prosodic variation in bilingual intonation patterns. A comparison of Yami and mainstream Mandarin intonations is given in Table 45. Results from this dissertation suggest

a discrepancy in NQ intonation and two phono-syntactic gaps between the two language systems. This comparison enables explorations for the trajectories of prosodic change and for what strategies bilinguals are likely to implement to reconcile discrepancies and gaps.

Table 45. Yami and mainstream Mandarin intonations

	ST	NQ	SQC	SQ1	SQ2
Yami	L%	L%	H%	↑H%	
Mainstream Mandarin	L%	M%		↑H%	↑M%

6.3.1 Mandarin influence on Yami

Two aspects of Yami intonation deserve further elaboration. First, prosodic transfer and innovation in Yami NQs. Second is the issue of tonal hybridization in Yami SQs. As will be discussed below, these unconventional forms indicate signs of Mandarin influence.

6.3.1.1 Yami NQ intonation: Prosodic transfer and innovation

Canonical Yami NQs take a shallow falling pattern. Yami-dominant and balanced bilinguals showed inconsistency in the use final L and H tones, and also employed a non-typical level intonation (M%) to encode their NQs. The new level pattern could possibly be seen as the product of transfer from Mandarin NQs.

As discussed in Section 2.1, variation in endangered language communities may be explained through language-decay (Sasse, 1992b) or contact-induced change model (Maher, 1991). I argue that Yami-dominant and balanced bilinguals' level NQ intonation is a "side effect" of language contact because all Yami-dominant and the majority of balanced bilingual participants

identified Yami as their L1 and possess full competence in Yami. It is therefore hard to explain the intonational variation through the language decay model (i.e., inadequate language knowledge). Their non-normative NQ pattern may thus be attributable to Mandarin influence via different transfer mechanisms.

As pointed out by Colantoni and Gurlekian (2004) and Romera and Elordieta (2013), prosodic features can be directly transferred from L2 to L1 via bilinguals. The bilinguals then serve as the "hub" to spread the L2 features to other community members' L1 speech through daily interaction. Following this, it could be that the balanced bilinguals, given their proficiency and frequent use of Mandarin, have directly transferred/borrowed the Mandarin-like level pattern to some of their Yami NQs. Meanwhile, Yami-dominant bilinguals, who still use Yami as the primary language in daily conversation, also showed instances of using a level pattern in their NQs, arguably due to social interactions with balanced bilinguals. This gives an illustration of indirect transfer. Different mechanisms for prosodic transfer are illustrated in Figure 47.

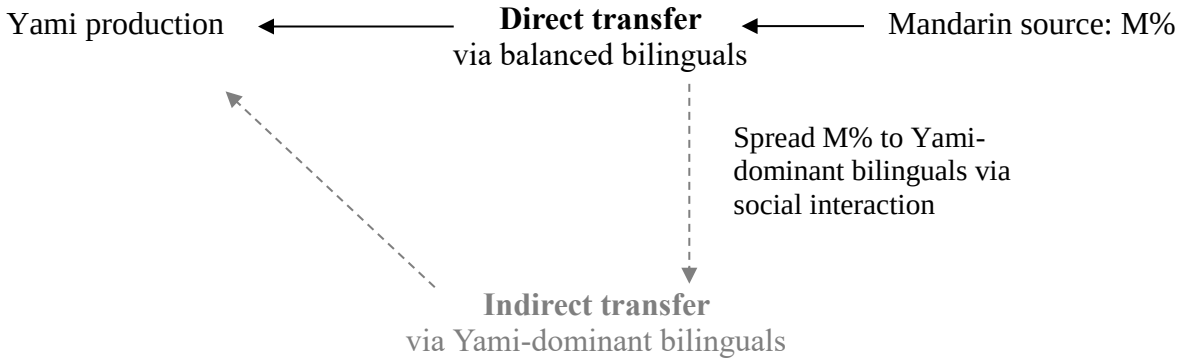


Figure 47. Prosodic transfer in Yami NQ intonation

A marked difference was found among Mandarin-dominant bilinguals, who explicitly used a novel rising pattern that is neither Mandarin- nor Yami-like. One possibility is that due to the lack of Yami grammatical proficiency, Mandarin-dominant bilinguals invariably adopt pitch rise

to perform query. The reduced complexity in Yami intonation produced by this group might be captured by the language decay model (Sasse, 1992b).

6.3.1.2 Yami SQ2: A hybridized pattern

For SQ2, I argue that Yami may not have an authentic SQ2, viz., the SQ1(↑H%)-SQ2(↑M%) distinction only exists in Mandarin and not in Yami. The new question type (Mandarin SQ2), however, seems to have been transplanted into Yami primarily by Mandarin-dominant bilinguals, whose Mandarin fluency has appreciably outstripped their Yami proficiency. However, when the new syntactic category is borrowed into Yami, the Mandarin SQ2 high-level (↑M%) intonation was not jointly transferred to Yami. Rather, Mandarin-dominant bilinguals filled the new syntactic category by mapping the already-existing Yami SQ1 high-rising (↑H%) intonation onto the newly added SQ2s. This demonstrates an interesting case of hybridization where a Mandarin SQ2 syntactic frame (blue shading in Figure 48) is fused with a Yami SQ intonation (green shading in Figure 48). Considering that Mandarin-dominant bilinguals are now leading this prosodic innovation in the Yami community, it is possible that younger Yami speakers may gradually form a SQ1-SQ2 contrast, making Yami become more similar to Mandarin in the future.

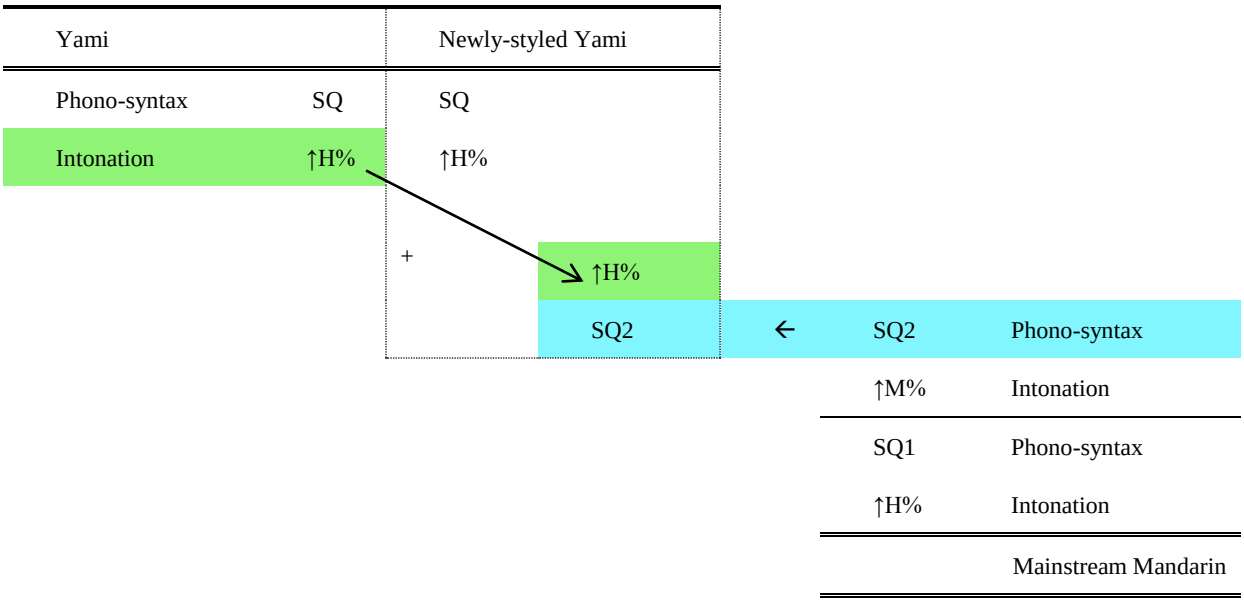


Figure 48. Hybridization of Mandarin phono-syntax and Yami intonation by Mandarin-dominant bilinguals

6.3.2 Yami influence on Orchid Island Mandarin

Simultaneously, Yami influence has also been attested in Orchid Island Mandarin, making it slightly different from mainstream Mandarin. As previously argued in Section 6.2.1.2, the SQ1 (↑H%)-SQ2 (↑M%) contrast only exists in mainstream Mandarin and not in Yami, and such a distinction only occurred among ethnically Yami, linguistically Mandarin-monolinguals (Figure 49a). The bilingual groups diverge from mainstream Mandarin patterns in different ways.

Yami-dominant bilinguals virtually merged their Mandarin SQ1s and SQ2s into a single group, which I interpret as a Yami phono-syntactic substrate (i.e., lack of SQ1-SQ2 distinction). In terms of intonation realization, they adopted a mainstream Mandarin SQ2-like, high-level pattern in both SQ1s and SQ2s (Figure 49c). Mandarin-dominant and balanced bilinguals, who are fully fluent in Mandarin and who are aware of the pragmatic difference between SQ1 and SQ2, lie

somewhere in between (Figure 49b). It seems that they attempted to keep the two questions apart, but the contrast is much smaller than that produced by the Mandarin-monolingual reference group.

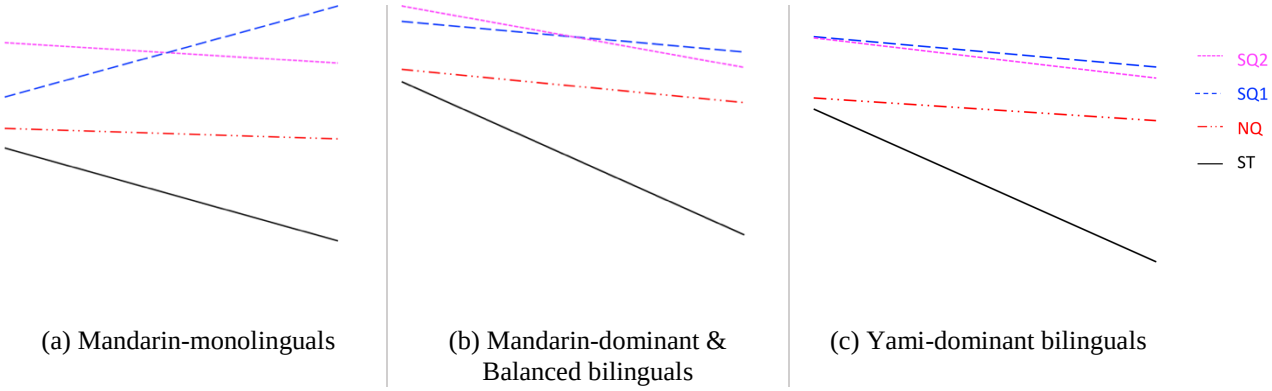


Figure 49. Orchid Island Mandarin intonation

The bilinguals' Mandarin production (Figure 49b and Figure 49c) embodies another hybridized pattern where Yami phono-syntax (a single SQ category, green shading in Figure 50) is intertwined with a mainstream Mandarin SQ2-like high-level intonation (↑M%, blue shading in Figure 50).

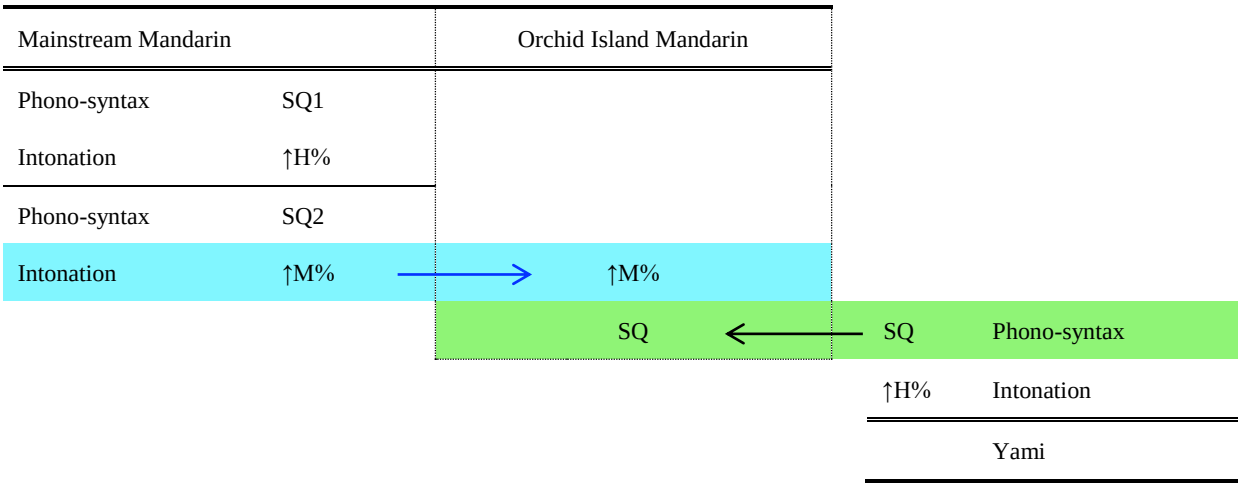


Figure 50. Hybridization of Yami phono-syntax and Mandarin intonation by Yami-Mandarin bilinguals

6.3.3 Section summary

There are two fundamental discrepancies between Yami and mainstream Mandarin: different NQ intonation and the lack of a SQ1-SQ2 contrast in Yami (Table 45). The results suggest that bilinguals develop different strategies to deal with these incongruencies.

To illustrate, NQs are realized differently in Yami (L%) and Mandarin (M%). The results indicate that when a feature (NQ) co-occurs in distinct language systems, and that they are in competition, balanced bilinguals show signs of integrating Mandarin intonational features into Yami and then spread the feature to the speech of Yami-dominant bilinguals.

Whereas when there is a phono-syntactic gap, the innovative, mainstream Mandarin SQ2 has been freshly carried over to the Yami system via Mandarin-dominant bilinguals. The newly created phono-syntactic vacancy is then fused with the pre-existing Yami intonation to form a hybridized system.

Last but not least, there is one salient variation in Mandarin-dominant bilinguals' NQ intonation. At first glance, their rising NQ intonation is surprising because it displays an innovation that is neither Yami- nor Mandarin-like. However, when looking at their Yami intonation, I found that Mandarin-dominant bilinguals invariably employed a rising intonation to convey interrogation (Figure 51). This could likely lead to convergence in their question intonation in the future.

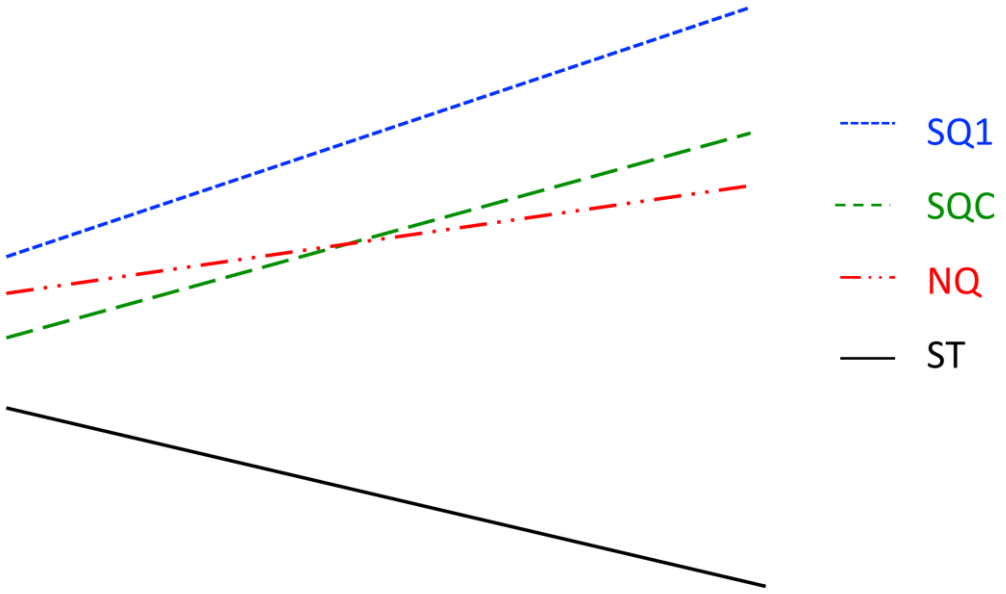


Figure 51. Yami intonation by Mandarin-dominant bilinguals (reproduced from Figure 40)

7.0 CONCLUSION

This chapter restates the goals of the dissertation and summarizes the major findings. I also reflect on limitations of the research and propose directions for future directions.

7.1 SUMMARY

"Language contact is the norm, not the exception" (Thomason, 2001: 10-12). However, imbalanced power relationships between groups of speakers have put minority languages in different levels of danger on a global scale. Yami, an indigenous language spoken in Taiwan is facing the same crisis under long-standing Mandarin hegemonic language policies. If no active action is taken, Yami will likely die within only one generation.

To show awareness for the current crisis, researchers have continued to provide timely description of Yami vitality and maintenance, morpho-syntax, and contact-influenced segmental variation. Yami intonation and prosody, conversely, has remained understudied so far. In addition, the impact of language contact on the intonation and prosody of Yami has not been fully explored before. To shed light on these issues, this dissertation takes a strong language contact approach to try to understand how bilinguals' language background and linguistic experience impact their intonation patterns. To achieve this goal, I provided a thorough description of the key aspects of Yami intonation, a crucial step that permits a cross-linguistic comparison between Yami and Mandarin to spot potential areas of prosodic change in bilingual speech. Next, I examined bilinguals' intonation patterns to see how distinct systems co-function in bilingualism.

Results from bilingual speech indicate initial signs of integrating level NQ intonation from Mandarin to Yami among Yami-dominant and balanced bilinguals. Mandarin-dominant bilinguals develop an innovative, high-rising intonation to encode their NQs instead. Interestingly, in addition to prosodic borrowing, the bilinguals exhibit creativity in their speech by developing a two-way tonal hybridization that intertwines discrete language sources (Section 6.3) in their statements questions (SQ1 and SQ2). To illustrate, the SQ1-SQ2 distinction only exists in mainstream Mandarin and not in Yami. I observed that Mandarin-dominant bilinguals displayed an innovation by borrowing a Mandarin syntactic category (SQ2) into their Yami production. The new question type is then fused with a pre-existing Yami intonation to form a hybrid pattern (i.e., mainstream Mandarin syntax + Yami intonation). If this innovation continues and strengthens, present-day Yami intonation may evolve over time into a newly-styled system as Mandarin is gaining ground on the Yami soil.

In the meantime, Yami influence was also detected in bilinguals' Mandarin production, making Orchid Island Mandarin distinct from mainstream Mandarin. Specifically, balanced and Yami-dominant bilinguals tended to merge SQ1 and SQ2 into a single SQ category, which is then intertwined with a mainstream-Mandarin-SQ2 intonation to form another hybrid pattern. Mandarin-monolinguals behaved differently from all bilingual groups by using a mainstream-Mandarin-like SQ1-SQ2 contrast. Mandarin-dominant bilinguals seem to fall somewhere in between. It seems that they are trying to set SQ1and SQ2 apart, but the distinction is not as clear as that made by their Mandarin-monolingual counterparts (cf. Figure 49).

Based on these findings, we see that younger islanders, including Mandarin-dominant bilinguals and Mandarin-monolinguals, are taking a lead in showing prosodic variations. Given the current linguistic ecological context on Orchid Island, it is plausible to argue that younger

islanders' speech is now in a transition phase and that there will be an in-progress asymmetrical convergence of the intonation systems from Yami to Mandarin in younger islanders' speech. Specifically, in the future, there might be SQ1-SQ2 distinction in Yami, and the localized Yami influence on Orchid Island Mandarin (a single SQ category) may be diluted, making it become similar to mainstream Mandarin (SQ1-SQ2 distinction) (Figure 52).

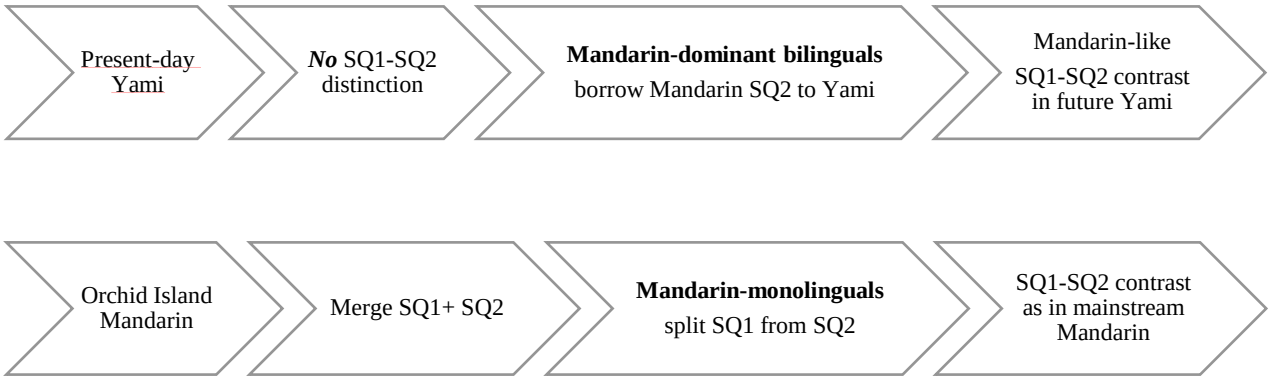


Figure 52. Potential evolution of Yami and Orchid Island Mandarin intonations

An important theoretical point I made in this dissertation is that, in addition to individual's language background, local language ecology also plays a vital role in shaping community members' linguistic behaviors. The main characteristics of the current ecological context of Orchid Island include drastic socioeconomic change, rapid language loss among youngers islanders, the "encroachment" of mainstream Mandarin speakers (i.e., mainlanders) accompanied by the booming tourism industry, the linguistic marketplace and value of Mandarin (key to economic success), the sociopolitical and sociocultural conflicts between islanders and outsiders, etc. These all operate to determine the linguistic outcomes among the community members.

Broadly, this Yami community presents a rather unique case seldom seen in pre-existing contact literature because it demonstrates how language contact between distinct prosodic typologies has altered bilingual speech in only a few decades. This dissertation also adds to the

body of work on the impact of language contact on intonation and prosody in other languages, particularly among indigenous/minority languages, as our knowledge in this field is still severely constricted.

This dissertation also has positive pedagogical implications and thus important broader impacts. First, I proposed a new paradigm, the Interactive Card Game, to elicit spontaneous speech in cross-cultural/cross-linguistic settings. I interacted Yami teachers during fieldwork; they found the games entertaining and expressed interests in incorporating them into the classroom (e.g., it is easy to embed different sentence types into the game tasks; the teaching aids are affordable, easy to prepare and make, etc.) to incite student interest in heritage language acquisition. Second, providing a thorough description of Yami intonation has the potential to help Yami teachers develop new strategies in teaching language prosody to help promote existing language revitalization efforts.

7.2 LIMITATIONS AND FUTURE DIRECTIONS

To my knowledge, this dissertation is the first attempt made to conduct a comprehensive investigation of Yami intonation and to study prosodic aspects of change under heavy influence from Mandarin. Despite the abovementioned contributions, there is still room for further improvements. First, as an initial investigation in endangered indigenous language intonation, the dissertation adopts a top-down approach which begins with the examination of global pitch trend and final boundary tone. A more fine-grained analysis of localized effects such as post-lexical pitch accents and word-level prosody is also needed to bolster our understanding of the

Yami prosodic system. Second, speaking rate can serve as an important cue to sentence type (van Heuven & van Zanten, 2005). It would be beneficial to include this parameter to see whether/how speaking rate facilitates encoding sentence type and how it interacts with pitch height and F_0 slope.

Currently, the dissertation has only dealt with variation in speech production, which is only part of the story underlying language use and change. In the future, I would like to incorporate perception into my research to pursue issues such as:

- Whether Yami listeners can correctly identify sentence types;
- Whether an individual's language background (Yami proficiency) affects their perceptual abilities;
- Perceived naturalness of sentence type, which is designated to see whether the non-typical realization of intonation (e.g., rising NQ) will be perceived as natural and authentic. If these variations are perceived as natural and are correctly assigned to a specific sentence type, it would further support the findings from the production tasks, which suggest a new direction in the evolution of Yami intonation system;
- When multiple cues are present, listeners weigh certain cues more than others. For instance, Spanish listeners rely more on the final pitch contours than the pre-nuclear or non-final peak height in the perception of sentence type (Trimble, 2013). What about Yami listeners? How will they weigh these cues available to them?
- The link between an individual's production and perception is not entirely straightforward. There is evidence showing that listeners can have the ability to use phonetic cues during perception even if they do not use those cues in production (Drager, 2010). Therefore, I would like to perform experiments with instrumentally manipulated speech to explore whether there is a one-to-one correspondence between production and perception, viz., can

Yami listeners detect those cues present in production and use them to facilitate sentence identification?

Of course, the ability to perceive language cues go hand in hand with production in replicating meaning and hence is a key aspect of the continued vitality of Yami and would further contribute to understanding of the linguistic challenges involved.

EPILOGUE

TOWARD UNIVERSAL PROCESSES IN PROSODIC CHANGE: A CONSTRAINT PROPOSAL

The Yami case is instructive as it suggests that, even though prosodic structure is highly language-specific, and the ecological context where language contact takes place vary, the outcomes of language contact on the phonological system are not random. Going beyond the particular case of Yami, this dissertation attempts to provide wider perspectives on what we might reasonably expect about general tendencies of prosodic change in a specific language ecology.

Using the idea of constraints, defined as the factors that determine whether or not language transfer occur, (Siegel, 1999; Winford, 2003: 340-346) and building on the cross-linguistic cases of contact-induced sound change (see Section 2.2), I posit five major constraints: *prosodic typology*, *prosodic contrast or gap*, *length of contact*, *intensity of contact*, and *social pressure*. I realize that the internal interaction of constraints is complex and highly language-specific and further that each sociolinguistic situation is unique. Furthermore, the details on the sociolinguistic context is scant in many studies, yet ironically this is the very information needed to properly define the ecological context in which contact exerts force on the prosodic system. For this reason, I can only make inferences and make such concepts like *length of contact* (e.g., long vs. short) and *intensity of contact* (e.g. more intense vs. less intense) remain unrefined for now. In this proposal, I place emphasis on the fulfillment (denoted as +) or violation (denoted as –) of the five constraints for each contact setting. Then, an overall constraint ranking is proposed. The higher the constraints

are positioned, the more influential their role in determining the outcome of prosodic changes. Note that in essence these constraints should be viewed as tendencies rather than absolutes.

Constraints on contact-induced prosodic change

The criteria defining violation or fulfillment of each of the five constraints are given below:

(a) Distinct prosodic typology: if the contact languages have distinct prosodic typologies (e.g., tone language in contact with non-tone language), they are considered to have fulfilled the constraint. In contrast, if the languages are similar in prosodic typology (e.g., two stress languages in contact), a violation was labeled.

(b) Prosodic difference: Romera & Elordieta (2013) noted that greater articulatory difference and perceptual salience trigger prosodic transfer. "Perceptual salience", however, is somewhat problematic because the perceived prosodic salience may vary from one individual or group to another. Thus, I leaned on the articulatory side to see whether there are fundamental prosodic contrasts (e.g., early peak alignment vs. late peak alignment, rising terminal tune vs. falling terminal tune, etc.) between the contact languages. A new dimension – prosodic gap is also included under the umbrella of prosodic difference because it represents a discrepancy between the two systems. If cross-linguistic "mismatchings" were reported, they satisfied the constraint. Otherwise, a violation was marked.

(c) Long contact history: I applied this constraint in the broadest sense – only when the original work explicitly stated that prosodic change took place within a short period of time was considered a violation of this constraint. Otherwise, I saw it as a fulfillment of the constraint.

(d) Intense language contact: intense contact is presumably more likely to cause prosodic

change. Therefore, speakers having limited intergroup interaction with foreign/L2 speakers was viewed as a violation of the constraint.

(e) Heavy social pressure: speakers are more likely to acquire foreign/L2 phonology under strong social pressure (Thomason & Kaufman, 1988: 35-39). In cases where speakers did not suffer heavy social pressure, a violation was marked.

Architecture

In Table 46, the leftmost column lists the cases of language contact, with the recipient language (L1, appear in green) coming before the source language (foreign/L2, appear in blue). From column two through six are the five constraints. Immediately after that is the outcomes of prosodic change such as L2 borrowing, bi-directional transfer, etc.

Table 46. Constraint tableau

Contact languages	Linguistic constraints		Social factors			Outcomes
	Distinct typology	Prosodic difference/gap	Long contact	Intense contact	Social pressure	
BA Spanish & Italian	–	+	+	+	–	L2 borrowing
Peninsular Spanish & Majorcan Catalan	–	+	–	–	+	L2 borrowing
Turkish & German	–	+	–	+	+	Fusion
Dutch & Greek	–	+	–	+	–	Bi-directional transfer
Quechua & Spanish	–	+	+	+	–	Fusion in Spanish
Spanish & Catalan in Majorca island	–	+	+	+	–	L2 borrowing
Yami & Mandarin	+	+	–	+	+	L2 borrowing & Hybrid system
Wutun Mandarin & Amdo Tibetan	+	unspecified	+	+	+	Hybrid system
Hui & Bonan	+	unspecified	+	+	–	Bi-directional transfer & Hybrid system
Papiamentu creole: West African & Portuguese	+	unspecified	+ / –	+ / –	+ / –	Hybrid system
Palenquero Creole: West African & Spanish	+	unspecified	+ / –	+ / –	+ / –	Hybrid system
Saramaccan: West African & English	+	Unspecified	+ / –	+ / –	+ / –	Hybrid system

Note: creole cases are more complex and should be split into pre- (upper left) and post- (bottom right) formation periods. These hybrid systems are arguably created during contexts of both intense contact and intense social pressure that do not exist now.

Ranking

Comparing the five constraints across all contact cases, I argue that distinct prosodic typology dominates other constraints as speakers unexceptionally developed hybrid systems when the languages have different prosodic typologies. Next, social pressure and intense contact come into play. Looking at either factor alone is not very informative because it is hard to specify sound change patterns. When both factors go hand in hand, two patterns emerge: under + intense contact and + social pressure condition, speakers tend to exhibit hybrid or fused patterns. Whereas under + intense contact and – social pressure condition, speakers show bi-directional transfer. Length of contact does not seem to very impactful because prosodic change can occur within a short period of contact. Based on information available in Table 46, it is hard to assess more precisely the importance of prosodic difference at this point. Future research would help provide some clarity to this issue. Also, the occurrence of L2 borrowing is hardly predicable because it can occur in all scenarios.

Summary

Based on the discussion, I propose an embedded structure, in which prosodic typology is positioned highest (first layer) in the scale, followed by the second-layered social pressure and intense contact constraints. Length of contact plays a lesser role in determining prosodic change patterns and so is placed at the lowest level (Figure 53).

				Outcomes
1st level	Prosodic typology			
	+			Hybrid pattern
2nd level		Social pressure	Contact intensity	
		+	+	Hybrid or Fused pattern
		–	+	Bi-directional transfer
3rd level			Contact length	

Figure 53. Layered constraint ranking

APPENDIX A

LANGUAGE EXPERIENCE AND PROFICIENCY QUESTIONNAIRE FOR YAMI-MANDARIN BILINGUALS

A.1 BASIC INFORMATION

性別 Gender　　年齡 Age　　填表日期 Today's date

男 Male　女 Female　　年　月　日

1. 您懂哪些語言？請圈選 Circle the languages you know

○ 雅美（達悟）Yami

Δ 華語 = 國語 Taiwanese Mandarin

✓ 閩南語 Taiwanese Southern Min

① 其他語言 1 Other language 1：＿＿＿＿＿＿＿

② 其他語言 2 Other language 2：＿＿＿＿＿＿＿

2. 請依序排出您各個語言的**流利度**（填寫代號即可）List the languages you know in order of **dominance**:

(1)　(2)　(3)　(4)　(5)

3. 請列出您就學前的**語言習得**順序（填寫代號即可）List the languages you know in order of **acquisition**:

(1)　(2)　(3)　(4)　(5)

4. 目前，各個語言的使用比率（填寫代號即可，各項比率總和為 100%）Please list what percentage of the time you are currently and on average exposed to each language. (Your percentages should add up to 100%):

語言 List language here:					
% List percentage here:					

5. 假設您要**閱讀**一段您不懂的外文，可以依照您的需求翻譯成任何您懂的語言，您希望翻譯成哪些語言？（填寫代號即可，各項比率總和為 100%）When choosing to **read** a text available in all your languages, in what percentage of cases would you choose to read it in each of your languages? Assume that the original was written in another language, which is unknown to you. (Your percentages should add up to 100%):

語言 List language here:					
% List percentage here:					

6. 與他人**對話**時，該名友人懂的語言跟您一樣多，且各個語言跟您一樣流利，您的語言使用比率（填寫代號即可，各項比率總和為 100%）When choosing a language to **speak** with a person who is equally fluent in all your languages, what percentage of time would you choose to speak each language? Please report percent of total time. (Your percentages should add up to 100%):

語言 List language here:					
% List percentage here:					

7. 一個人可能有多重的文化/身份認同，您認為您是（可複選，認同度 0 最低，10 最高） Please name the cultures with which you identify. On a scale from 0 to 10, please rate the extent to which you identify with each culture.

蘭嶼人 Yami	0	1	2	3	4	5	6	7	8	9	10
臺灣人 Taiwanese	0	1	2	3	4	5	6	7	8	9	10
其他 1 Other identity 1：	0	1	2	3	4	5	6	7	8	9	10
其他 2 Other identity 2：	0	1	2	3	4	5	6	7	8	9	10

8. 請圈選您的最高學歷 Please circle your highest education level:

國小以下 Less than elementary school	國小 Elementary school	國中 Junior high school	高中/職 High school/Vocational school
大專院校 College	碩士 Masters	博士 PhD/MD/JD	其他 Other:

9. 您是否曾有過有聽力或語言障礙病史？ 是 否 Have you ever had hearing impairment or language disability?

A.2 YAMI PROFICIENCY AND LANGUAGE USE

雅美（達悟）語是您的（母　第二　第三　第四　第五）語言 Yami is your (first, second, third, etc.) language.

1. 請填寫下列各階段的大約年齡 Age when you…

開始說雅美（達悟）語 began acquiring Yami	能夠流利講雅美（達悟）語 became fluent in Yami	開始**閱讀**雅美（達悟）文體 began reading in Yami	能夠通暢**閱讀**雅美（達悟）文體 began fluent reading in Yami

2. 雅美（達悟）語語言流利度自評 （ 流利度 0 最低，10 最高）On a scale from 0 to 10, please select your level of proficiency in speaking, understanding, reading, and writing:

口說能力 Speaking	0	1	2	3	4	5	6	7	8	9	10
理解口語能力 Understanding spoken language	0	1	2	3	4	5	6	7	8	9	10
閱讀能力 Reading	0	1	2	3	4	5	6	7	8	9	10
寫作能力 Writing	0	1	2	3	4	5	6	7	8	9	10

3. 以下哪些管道有助於增進您的雅美（達悟）語能力（ 有益程度 0 最低，10 最高） On a scale from 0 to 10, please select how much the following factors contribute to you using Yami:

與蘭嶼當地友人互動 Interacting with friends	0	1	2	3	4	5	6	7	8	9	10
與家人互動 Interacting with family	0	1	2	3	4	5	6	7	8	9	10
自學，教材：＿＿＿＿＿＿＿＿ Self instruction	0	1	2	3	4	5	6	7	8	9	10
電視節目，例如：族語新聞 Watching TV	0	1	2	3	4	5	6	7	8	9	10
蘭嶼廣播電台 Listening to the radio	0	1	2	3	4	5	6	7	8	9	10
其他，例如：Other(s), e.g.,	0	1	2	3	4	5	6	7	8	9	10
母語教學 Yami teaching	0	1	2	3	4	5	6	7	8	9	10
個人文史研究 Private workshop on Yami language & culture	0	1	2	3	4	5	6	7	8	9	10
參與蘭嶼當地***團體***研究計畫 Local research project	0	1	2	3	4	5	6	7	8	9	10
參與***非***蘭嶼當地發起的學術研究 Academic research	0	1	2	3	4	5	6	7	8	9	10
從事（經典）翻譯 Translation	0	1	2	3	4	5	6	7	8	9	10
其他 Other ：＿＿＿＿＿＿＿＿＿	0	1	2	3	4	5	6	7	8	9	10

4. **目前**，在下列場合/情境下，您會接觸到雅美（達悟）語的程度（ 接觸程度 0 最低，10 最高 ） On a scale from 0 to 10, please rate to what extent you are currently exposed to Yami in the following contexts:

與蘭嶼當地友人互動 Interacting with friends	0	1	2	3	4	5	6	7	8	9	10
與家人互動 Interacting with family	0	1	2	3	4	5	6	7	8	9	10
自學，教材：_ _ _ _ _ _ _ _ Self instruction	0	1	2	3	4	5	6	7	8	9	10
電視節目，例如：族語新聞 Watching TV	0	1	2	3	4	5	6	7	8	9	10
蘭嶼廣播電台 Listening to the radio	0	1	2	3	4	5	6	7	8	9	10
網路 Surfing the internet	0	1	2	3	4	5	6	7	8	9	10
其他，例如：Other(s), e.g.,	0	1	2	3	4	5	6	7	8	9	10
母語教學 Yami teaching	0	1	2	3	4	5	6	7	8	9	10
個人文史研究 Privately workshop on Yami language & culture	0	1	2	3	4	5	6	7	8	9	10
參與蘭嶼當地***團體***研究計畫 Local research project	0	1	2	3	4	5	6	7	8	9	10
參與***非*** 蘭嶼當地發起的學術研究 Academic research	0	1	2	3	4	5	6	7	8	9	10
從事（經典）翻譯 Translation	0	1	2	3	4	5	6	7	8	9	10
工作場所 Work place	0	1	2	3	4	5	6	7	8	9	10
宗教場所 Religious settings	0	1	2	3	4	5	6	7	8	9	10
傳統慶典 Cultural festivals	0	1	2	3	4	5	6	7	8	9	10
當地協會/組織 Local club or organization	0	1	2	3	4	5	6	7	8	9	10
其他 Other ：_ _ _ _ _ _ _ _ _ _	0	1	2	3	4	5	6	7	8	9	10

5. **您認為**您的雅美（達悟）語，聽起來有不自然的腔調嗎？（不自然程度 0 最低，10 最高）In your perception, how much of a non-native accent do you have in Yami:

0	1	2	3	4	5	6	7	8	9	10
沒有					中等					極重

6. 曾有**當地人**說過您的雅美（達悟）語，聽起來有不自然的腔調嗎？ Please rate how frequently others identify you have a non-native accent in Yami:

0	1	2	3	4	5	6	7	8	9	10
從來沒有					有時候					總是如此

A.3 MANDARIN PROFICIENCY AND LANGUAGE USE

華語是您的（母　第二　第三　第四　第五）語言 Mandarin is your (first, second, third, etc.) language.

1. 請填寫下列各階段的大約年齡 Age when you…

開始說華語 began acquiring Yami	能夠流利講華語 became fluent in Yami	開始**閱讀**中文 began reading in Yami	能夠通暢**閱讀**中文文體 began fluent reading in Yami

2. 華語語言流利度自評（流利度 0 最低，10 最高）On a scale from 0 to 10, please select your level of proficiency in speaking, understanding, reading, and writing:

口說能力 Speaking	0	1	2	3	4	5	6	7	8	9	10
理解口語能力 Understanding spoken language	0	1	2	3	4	5	6	7	8	9	10
閱讀能力 Reading	0	1	2	3	4	5	6	7	8	9	10
寫作能力 Writing	0	1	2	3	4	5	6	7	8	9	10

3. 以下哪些管道有助於增進您的華語能力（有益程度 0 最低，10 最高）On a scale from 0 to 10, please select how much the following factors contribute to you using Mandarin:

與蘭嶼當地友人互動 Interacting with friends	0	1	2	3	4	5	6	7	8	9	10
與***非***蘭嶼當地友人互動 Interacting with non-Yami friends	0	1	2	3	4	5	6	7	8	9	10
閱讀中文文章 Reading	0	1	2	3	4	5	6	7	8	9	10
自學，教材：＿＿＿＿＿＿＿＿ Self instruction	0	1	2	3	4	5	6	7	8	9	10
電視節目 Watching TV	0	1	2	3	4	5	6	7	8	9	10
收聽廣播電台 Listening to the radio	0	1	2	3	4	5	6	7	8	9	10
上網 Surfing the internet	0	1	2	3	4	5	6	7	8	9	10
其他，例如：Other(s), e.g.,	0	1	2	3	4	5	6	7	8	9	10
個人文史研究 Private workshop on Yami language & culture	0	1	2	3	4	5	6	7	8	9	10
參與蘭嶼當地***團體***研究計畫 Local research project	0	1	2	3	4	5	6	7	8	9	10
參與***非***蘭嶼當地發起的學術研究 Academic research	0	1	2	3	4	5	6	7	8	9	10
從事（經典）翻譯 Translation	0	1	2	3	4	5	6	7	8	9	10
其他 Other：＿＿＿＿＿＿＿＿＿＿	0	1	2	3	4	5	6	7	8	9	10

4. **目前**，在下列場合/情境下，您會接觸到華語的程度（ 接觸程度 0 最低，10 最高）On a scale from 0 to 10, please rate to what extent you are currently exposed to Yami in the following contexts:

與蘭嶼當地友人互動 Interacting with friends	0	1	2	3	4	5	6	7	8	9	10
與家人互動 Interacting with family	0	1	2	3	4	5	6	7	8	9	10
閱讀報章雜誌 Reading	0	1	2	3	4	5	6	7	8	9	10
電視節目 Watching TV	0	1	2	3	4	5	6	7	8	9	10
廣播電台 Listening to the radio	0	1	2	3	4	5	6	7	8	9	10
網路 Surfing the internet	0	1	2	3	4	5	6	7	8	9	10
其他，例如：Other(s), e.g.,	0	1	2	3	4	5	6	7	8	9	10
個人文史研究 Privately workshop on Yami language & culture	0	1	2	3	4	5	6	7	8	9	10
參與蘭嶼當地***團體***研究計畫 Local research project	0	1	2	3	4	5	6	7	8	9	10
參與***非***蘭嶼當地發起的學術研究 Academic research	0	1	2	3	4	5	6	7	8	9	10
工作場所 Work place	0	1	2	3	4	5	6	7	8	9	10
宗教場所 Religious settings	0	1	2	3	4	5	6	7	8	9	10
傳統慶典 Cultural festivals	0	1	2	3	4	5	6	7	8	9	10
當地協會/組織 Local club or organization	0	1	2	3	4	5	6	7	8	9	10
其他 Other：＿＿＿＿＿＿＿＿＿＿	0	1	2	3	4	5	6	7	8	9	10

5. **您認為**您的華語，聽起來有不自然的腔調嗎？（不自然程度 0 最低，10 最高）In your perception, how much of a non-native accent do you have in Mandarin:

0	1	2	3	4	5	6	7	8	9	10
沒有					中等					極重

6. 曾有人說過您的華語，聽起來有不自然的腔調嗎？ Please rate how frequently others identify you have a non-native accent in Mandarin:

0	1	2	3	4	5	6	7	8	9	10
從來沒有					有時候					總是如此

7. 語言使用回顧 Language use pattern in different life stages

人生階段 Life stages		母語為主 Yami	華語為主 Mandarin	母語、華語混用 Both Yami & Mandarin	其他 Other(s)
就學前的主要語言 Primary language(s) you used at preschool age					
國小階段的主要語言 Main language you spoke after attending the primary school	家庭 Family				
	學校 School				
青少年（國、高中）階段的主要語言 Primary language used in your teenage years	家庭 Family				
	學校 School				
成年（18 歲）後的主要語言 Main language you used since you have become an adult	家庭 Family				
	工作場合 Work place				
目前的主要語言 Primary language now	家庭 Family				
	工作場合 Work place				

A.4 RESIDENTIAL, TRAVEL, AND WORK EXPERIENCE

居住、旅居臺灣、工作經驗

1. 出生地 Place of birth: **紅頭** Imowrod **漁人** Iratay **椰油** Yayo **朗島** Iraralay **東清** Iranmilek **野銀** Ivalino

2. 成長/居住地 Place of residence

- **國小/中畢業以前** Before graduating from middle school

  出生地 Place of birth ＝ 成長地 Place of residence （請圈選） **是** Yes **否** No

若答案為否，您住過哪些地方？If not, which place(s) did you lived & for how long?

成長地 1 Place of residence 1	蘭嶼 Orchid Island	紅頭 Imowrod 漁人 Iratay 椰油 Yayo 朗島 Iraralay 東清 Iranmilek 野銀 Ivalino _____年 Year
	其他 Other place	_ _ _ _縣 County/市 City _____年 Year
成長地 2 Place of residence 2	蘭嶼 Orchid Island	紅頭 Imowrod 漁人 Iratay 椰油 Yayo 朗島 Iraralay 東清 Iranmilek 野銀 Ivalino _____年 Year
	其他 Other place	_ _ _ _縣 County/市 City _____年 Year

- **國小/中畢業後** After middle school

  曾到臺灣工作/求學？Have you ever worked or studied in Taiwan? **是** Yes **否** No

  若答案為**是**， 您住過哪些地方？If yes, which place(s) did you live & for how long?

臺灣居住地 1 Place of residence in Taiwan 1	_ _ _ _ 縣 County/市 City _____年 Year
臺灣居住地 2 Place of residence in Taiwan 2	_ _ _ _ 縣 County/市 City _____年 Year

- **現居地** Current residence: **紅頭** Imowrod **漁人** Iratay **椰油** Yayo **朗島** Iraralay **東清** Iranmilek **野銀** Ivalino _____年

3. 目前主要職業（**請擇一**）Current major occupation

農、漁業 Farming or fishing	家管 Homemaker	宗教相關 Religious profession	文教業 Education 母語教師 文史工作者 學校教師 - 幼兒園 - 國小 - 國中 - 高中	工 Laborer	公務機關 Government employee	服務業（圈選） Service industry 民宿 餐飲 導遊 商店 手工藝品 其他 _ _ _ _	其他 Other _ _ _ _ _ 學生 Student

APPENDIX B

SUMMARY OF PARTICIPANT PROFILE

Table 47. Participant characteristics

Participant ID	Village/Place where you grew up	Gender	Age	Language dominance	Primary language at preschool age	% of language use	Age of reaching fluent Yami	Ratio	Group
1	Ivalino	Female	56	Y > M	Yami	Y80 + M20	7	0.24	YD
2	Ivalino	Male	58	Y > M	Yami	Y50 + M50	7	0.23	YD
3	Iratay	Female	55	Y > M	Yami	Y70 + M30	6	0.14	YD
4	Imowrod	Female	56	Y > M	Yami	Y60 + M40	5	0.17	YD
5	Iraralay	Female	45	M > Y	Yami	Y50 + M50	7	1.5	BB
6	Iraralay	Female	45	M > Y	Yami	Y40 + M60	20	0.5	BB
7	Yayo	Male	52	Y > M	Yami	Y60 + M40	7	0.54	YD
8	Yayo	Female	52	M > Y	Yami	Y70 + M30	25	0.28	YD
9	irmk	Female	58	Y > M	Yami	Y80 + M20	7	0.02	YD
10	irmk	Female	52	Y > M	Yami	Y80 + M20	7	0.06	YD
11	Iraralay	Female	41	Y > M	Yami	Y70 + M30	6	0.04	YD
12	Yayo	Female	42	M > Y	Yami	Y30 + M70	18	0.05	BB
13	Iraralay	Female	37	M > Y	Yami	Y40 + M60	6	2.67	MD
14	Iraralay	Female	37	M > Y	Yami	Y30 + M70	7	0.29	MD
15	Iraralay	Male	42	Y > M	Yami	Y80 + M20	6	10	BB
16	Iraralay	Female	37	M > Y	Mandarin	Y20 + M80	7	10	MD
17	Iraralay	Female	42	Y > M	Yami	Y40 + M60	7	0.57	BB
18	Iranmilek	Female	34	M > Y	Yami	Y30 + M70	5	1.34	MD
19	Iranmilek	Male	60	Y > M	Yami	Y60 + M40	5	0.55	YM
20	Iraralay	Female	56	Y > M	Yami	Y80 + M20	6	0.32	YD
21	Yayo	Female	45	M > Y	Yami	M80 + Y20	38	1.5	BB
22	Yayo	Female	49	M > Y	Yami	M50 + Y50	13	2.4	BB
23	Iranmilek	Female	56	M > Y	Yami	Y40 + M60	34	1.6	BB
24	Yayo	Female	42	M > Y > TSM	Yami	Y30 + M50 + TSM20	10	0.59	BB
25	Taiwan	Female	25	M > Y	Mandarin	Y45 + M55	18	4	MD
26	Iratay	Male	23	M > Y	Mandarin	Y30 + M70	12	1.5	MD
27	Ivalino	Female	48	Y > M	Yami	Y50 + M50	5	10	BB
28	Yayo	Female	45	M > Y	Yami	Y20 + M80	38	1.5	BB
29	Yayo	Male	47	Y > M	Yami	Y50 + M50	13	1.67	BB
30	Iranmilek	Male	38	M > Y	Mandarin	Y15 + M85	12	2.14	MD
31	Iranmilek	Male	36	M > Y	Mandarin	Y30 + M70	7	2.5	MD
32	Iratay	Female	65	Y > M	Yami	Y 100	7	0.11	YM
33	Iranmilek	Male	62	Y > M	Yami	Y50 + M50	6	1.76	YD
34	Iranmilek	Female	62	Y > M	Yami	Y50 + M50	7	1.76	YD
35	Yayo	Female	69	Y > M	Yami	Y100	5	0.06	YM

36	Yayo	Male	67	Y > M	Yami	Y100	5	0.01	YM
37	Yayo	Female	63	Y > M	Yami	Y100	5	0.02	YM
38	Iranmilek	Male	33	M > Y	Mandarin	Y15 + M85	NA	0.77	MM
39	Iranmilek	Male	31	M > Y	Mandarin	Y10 + M90	NA	0.96	MM
40	Taiwan	Female	23	M > Y	Mandarin	Y30 + M70	NA	0.81	MM
41	Taiwan	Male	19	M > Y	Mandarin	Y30 + M70	NA	0.83	MM
42	Taiwan	Female	19	M > Y > TSM	Mandarin	M50 + Y30 + TSM20	NA	0.86	MM
43	Taiwan	Female	19	M > Y	Mandarin	Y20 + M80	16	0.97	MM
44	Iratay	Female	31	M > Y	Yami	Y30 + M70	NA	0.82	MM

Abbreviations: In the “language dominance” and “% of language use” columns, Y = Yami, M = Mandarin, TSM = Taiwanese Southern Min. In the “group” column, YM = Yami-monolingual, YD = Yami-dominant bilingual, BB = balanced bilingual, MD = Mandarin-dominant bilingual, MM = Mandarin-monolingual.

APPENDIX C

FAMILIARIZATION LEAFLET

			
angit 天空	talinga 耳朵	lratai 漁人	talili 上衣、衣服
			
ataw 海水	sazowsaw（微）風	pongso 島嶼	lima 手
			
ayo 河流	lilisnan 椅子	vehan 月亮	lila 舌頭
			
sosoli 芋頭	lraraley 朗島	lvalino 野銀	kamaliq 船屋

Figure 54. Schematized familiarization leaflet

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