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Intonation and emotions in Kɔnni

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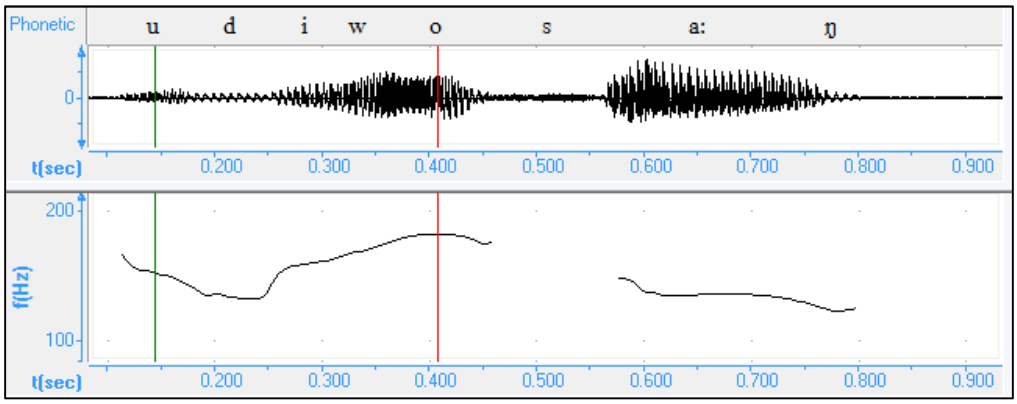
1. Introduction

- Intonation in tone languages has not been studied nearly as much as in non-tonal languages, often assuming that tone would negate any intonation pitch differences
- Tone languages *do* often use particles, rather than pitch, to indicate grammatical functions such as narrow focus, e.g. "You DROVE to the store" (not WALKED…).
- However, *paralinguistic* functions of intonation are more amenable to study; one of these is the use of gradient changes of pitch and duration to indicate emotional states of the speaker (Gussenhoven 2004, Ladd, Sherer, and Silverman 1986).
- The current study[1]:
    - Two native speakers of Kɔnni ([kom], Gur), first said a sentence normally, then repeated as if surprised, bored, angry, "contemptuous," and emphatic. One sentence was processed by both, and Salifu processed 6 more.
    - Each sentence repeated 3 times. The "surprise" response often resulted in the speakers' producing a polar question, e.g. "S/he went to market" became "S/he went to market?" These are discussed somewhat separately in this study.
    - The pitch ***range*** and base pitch ***level*** were measured, by measuring the frequency of the initial Low tone and the first High tone in the utterance. All utterances had a Low-toned pronoun initially, and a High-toned verb suffix:

[1] The data for this study was gathered by Mr. Konlan Kpeebi of the Ghana Institute of Linguistics, Literacy, and Bible Translation (GILLBT). He recorded Mr. Naaza Solomon Dintigi and Mr. Mumuni Salifu Barnabas in a recording studio in Tamale, Ghana. I am extremely grateful to all of them for their input and expertise. Specifics of the recording hardware are not available, but the recording quality was free of roosters and other outside noises so frequently encountered in field recording situations, and the quality was more than adequate for pitch analysis.

(1) **ù** dìì-**wó** ǃsááŋ ‘s/he ate TZ’ (a type of porridge)



- Pitch *level* above would be the frequency at the left cursor, at the Low toned [ù]. Pitch *range* would be the difference between this Low and the High of the [wó] syllable at the right cursor.
- Duration has also been found relevant in studies of other languages, and this was also measured.
    - regular and systematic differences between neutral and the various emotional states for which data was gathered.

2. The Results

- All the numbers below are averages of the three utterances of that particular sentence. Frequencies are in Hz, duration in ms.

- Abbreviations:
    - EXP/exp = expanded range (larger L-H difference)
    - CONT = contracted range (smaller L-H difference)
    - “l” preceding a note means that it’s a “little” more of that quality

- We will see that the “surprise” intonation most often elicited a *polar question* as its expression. As detailed in Cahill (2012), a polar question in Kɔnni is raised, and has some variety of a falling tone on the final syllable. That syllable is lengthened, and this accounts for the total duration of the “surprise” intonation being lengthened in all the measurements to follow (and why I label it “longer” rather than “slower”).

Results from one sentence, two speakers:

(2) She has cooked yams: **ù** dìgì**wó nyó**à Solomon

	L (Hz)	H (Hz)	range (H-L)	duration	compared to neutral
neutral	128	153	25	798	-----
bored	128	157	29	810	l-exp, l-slower
angry	152	182	30	697	higher, l-exp, faster
contemptuous	147	177	30	738	higher, l-exp, faster
emphatic	135	172	37	743	l-higher, EXP, faster
surprise (no Q)	156	185	29	703	higher, faster

(3) She has cooked yams: **ù** dìgì**wó nyó**à Salifu

	L (Hz)	H (Hz)	range (H-L)	duration	compared to neutral
neutral	134	155	21	680	----
bored	140	164	24	629	l-higher, l-exp, faster
angry	142	172	32	682	higher, EXP
contemptuous	139	167	28	679	l-higher, exp
emphatic	142	180	38	706	higher, EXP, slower
surprise -Q	146	186	40	774	higher, EXP, longer

- The first thing to note is that the two speakers had some variation in their expressions. Especially, the "bored" expression was slower for Solomon and faster for Salifu. Solomon's "angry" and "emphatic" expressions were faster than Salifu's. There was other minor variation, but the main difference was *speed* in three utterances.
- Both speakers agreed that "bored" was a little expanded, that "angry" was definitely higher with an expanded range, that "contemptuous" was slightly higher and slightly expanded, and that "emphatic" was higher, with an expanded range.
- On "surprise," Salifu consistently responded by turning the statement into a polar (yes/no) question ("she has cooked yams?") and that will be discussed later. Solomon, however, uttered a non-question surprise intonation, which was higher and faster. It seems likely that pragmatically the polar question is a more natural response to a surprising situation, but this cannot be verified at this point.

Results of all other test sentences – one speaker

(4) She went to market: **ù** gà**wá** ꜜnyúŋ Salifu, in a different session than others

	L (Hz)	H (Hz)	range (H-L)	duration	compared to neutral
neutral	150	189	39	651	-----
surprise (Q)	158	226	67	804	Higher, EXP, longer
bored	135	169	34	552	lower, l-CONT, faster
angry	150	203	53	558	EXP, faster
contemptuous	134	166	32	548	lower, l-CONT, faster
emphatic	159	212	53	704	higher, EXP, slower

- In this set of data, besides the above, I also noted the volume of these. The "bored" and "contemptuous" versions were quieter, and "emphatic" was louder ("angry" was approximately the same volume).

(5) He has bought oil: **ù** dàà**wá** kpááŋ Salifu

	L (Hz)	H (Hz)	range (H-L)	duration	compared to neutral
neutral	134	144	10	700	-----
surprise **Q**	152	185	33	806	higher, EXP, longer
bored	140	155	15	629	l-higher, exp, faster
angry	140	172	32	682	l-higher, EXP, faster
contemptuous	134	149	15	692	l-exp, l-faster
emphatic	145	172	27	717	higher, EXP, slower

(6) He has cooked eggs: **ù** dìgì**wó** gílà Salifu

	L (Hz)	H (Hz)	range (H-L)	duration	compared to neutral
neutral	139	162	23	658	-----
surprise Q	148	198	50	763	higher, EXP, longer
bored	139	158	19	614	l-CONT, faster
angry	146	184	38	672	l-higher, EXP, slower
contemptuous	144	165	21	669	l-higher, l-CONT, l-slower
emphatic	146	181	35	668	l-higher, EXP, l-slower

(7) He has fried eggs: **ù** chùŋ**wá** gílà Salifu

	L (Hz)	H (Hz)	range (H-L)	duration	compared to neutral
neutral	132	163	31	716	-----
surprise **Q**	148	189	41	779	higher, EXP, longer
bored	133	156	23	683	CONT, faster
angry	130	181	51	716	EXP
contemptuous	135	159	24	706	CONT, l-faster
emphatic	142	184	42	725	higher, EXP, slower

(8) He has eaten TZ: **ù** dùù**wó** ꜜsááŋ Salifu

	L (Hz)	H (Hz)	range (H-L)	duration	compared to neutral
neutral	139	173	34	697	-----
surprise Q	155	205	50	756	higher, EXP, longer
bored	137	162	25	679	CONT, faster
angry	Missing data				
contemptuous	138	162	24	713	CONT, slower
emphatic	143	191	48	713	l-higher, EXP, slower

(9) He has fetched fire **ù** chɔgìsì**wó** ꜜbólíŋ Salifu

	L (Hz)	H (Hz)	range (H-L)	duration	compared to neutral
Neutral	139	191	52	801	-----
surprise Q	148	196	48	909	higher, EXP, longer
Bored	131	157	26	804	lower, CONT
Angry	136	200	64	760	l-EXP, faster
Contemptuous	132	169	37	779	l-lower, CONT, faster
Emphatic	142	199	57	802	l-higher, l-EXP

3. Summary

- Though unsurprisingly there is some variation, nonetheless there are some generalizations to be extracted as well. Results are expressed below.

(10) Summary of results – copied from (2-9)

S/he has…	bored	angry	contemptuous	emphatic	surprise
cooked yams Solomon	l-slower	higher, l-exp, faster	higher, l-exp, faster	l-higher, EXP, faster	higher, faster –*not* Question
Salifu	l-higher, l-exp, faster	higher, EXP	l-higher, exp	higher, EXP, slower	higher, EXP, longer
gone to market[2]	lower, l-CONT, faster	EXP, faster	lower, l-CONT, faster	higher, EXP, slower	higher, EXP, longer
bought oil	l-higher, exp, faster	l-higher, EXP, faster	l-exp, l-faster	higher, EXP, slower	higher, EXP, longer
cooked eggs	l-CONT, faster	l-higher, EXP, slower	l-higher, l-CONT, l-slower	l-higher, EXP, l-slower	higher, EXP, longer
fried eggs	CONT, faster	EXP	CONT, l-faster	higher, EXP, slower	higher, EXP, longer
eaten TZ	CONT, faster	*no data*	CONT, slower	l-higher, EXP, slower	higher, EXP, longer
fetched fire	lower, CONT	l-EXP, faster	l-lower, CONT, faster	l-higher, l-EXP	higher, EXP, longer

- The "bored" expressions in Salifu's speech were consistently faster than the neutral, and most of the time had a contracted range. No consistent pattern of raising or lowering was found.
- The "contemptuous" expressions in Salifu's speech varied in speed, but were generally faster than neutral, and most of the time had a contracted range. Again, no consistent pattern of raising or lowering was found.

[2] Recorded in a different session than the others

- The “bored” and “contemptuous” patterns thus resembled each other quite a lot.
- The “angry” expression was sometimes higher than neutral, mostly faster, but always with an expanded range.
- The “emphatic” expression was always higher, always with expanded range, and almost always slower.
- The “surprise” was always higher, with an expanded range, and longer. I use “longer” rather than “slower” because there is always an extra mora added.
- These are displayed below, with the caveat that these highest level generalizations conceal some detail.

(11) Properties of emotions in Kɔnni

	base pitch	range	speech rate	volume
bored	neutral	contracted	faster	quieter
contemptuous	neutral	contracted	varied/faster	quieter
angry	little higher	expanded	faster	same
emphatic	higher	expanded	slower	louder
surprise	higher	expanded	longer	

4. Discussion

- The similarity between the “bored” and the “contemptuous” very tentatively may suggest that these are closely related in Kɔnni speakers’ minds. It is easy to imagine that someone who is expressing contempt would act as if he were bored. This deserves more investigation.
- If we count “bored/contemptuous” as one, there are four distinct patterns of intonation that indicate emotional states.
- The obvious follow-up study is to see if other Kɔnni speakers could reliably identify the emotion acted out. With the long-distance setup here, this was impractical. Also, ideally recordings would be made in natural settings rather than the artificial acting out.

- It has been known that people can recognize *some* emotions cross-linguistically. Gussenhoven (2004:72) cites Bezooijen (1984:128) in a case of this. Taiwanese and Japanese speakers identified sadness, anger, and surprise by Dutch speakers at above chance levels. However, contempt and shame were not recognized.

These results are compatible with those found in other languages, (Cruttenden 1997), and specifically add to the knowledge of how tone languages are able to express paralinguistic intonation in a systematic way.

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