ism: Improvisation Supporting Systems with Melody Correction and Key Vibration

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Our goal

Our goal:

To popularize *active ways* of enjoying music

What's the *active ways*?

To enjoy music through *creating* one

e.g. composition, performance, jam session

our target

But...

It's difficult for inexperienced people

Support such beginners' jam sessions with computing technologies

Existing studies aim new style jam sessions
Only a few studies aim beginner support

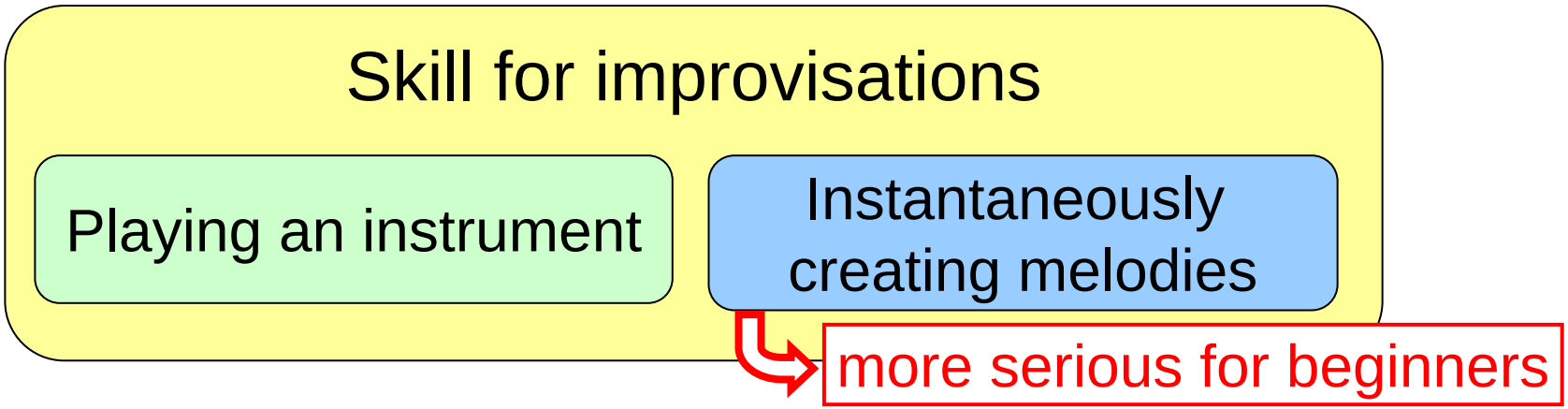
Jam Session

Jam session:

A musical act where musicians gather and play *improvisations*
(i.e. without preparing melodies, etc.)

Why is it difficult?

Improvisations involve *creating melodies* at the same time as playing an instrument



Our Concepts

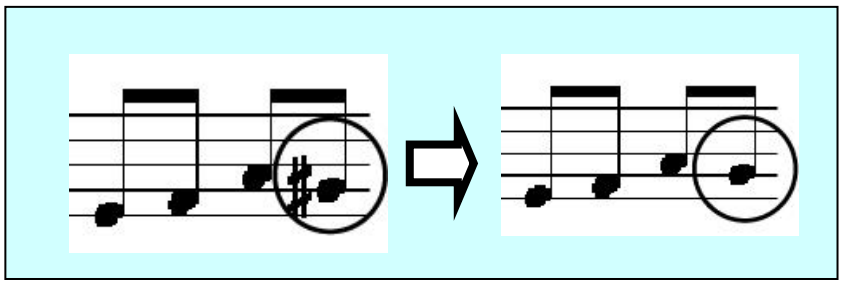
2 key concepts for the support

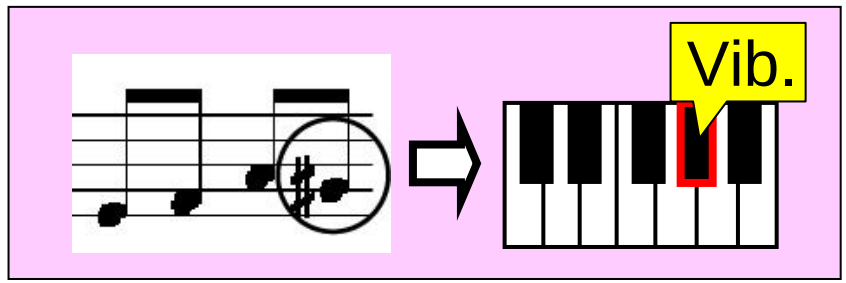
- To enhance the skill for melody creation
  - ⇨ ***ism***: *Melody correction*

If the user plays musically inappropriate notes, the system automatically corrects them

- To support the practice for improving the skill
  - ⇨ ***ism$_v$***: *Key vibration*

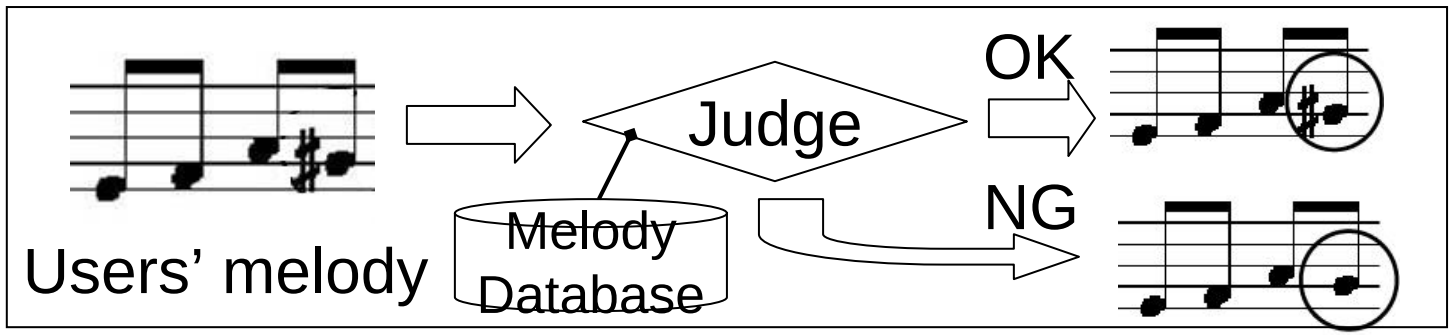
If the user plays musically inappropriate notes, the system points them out via key vibration





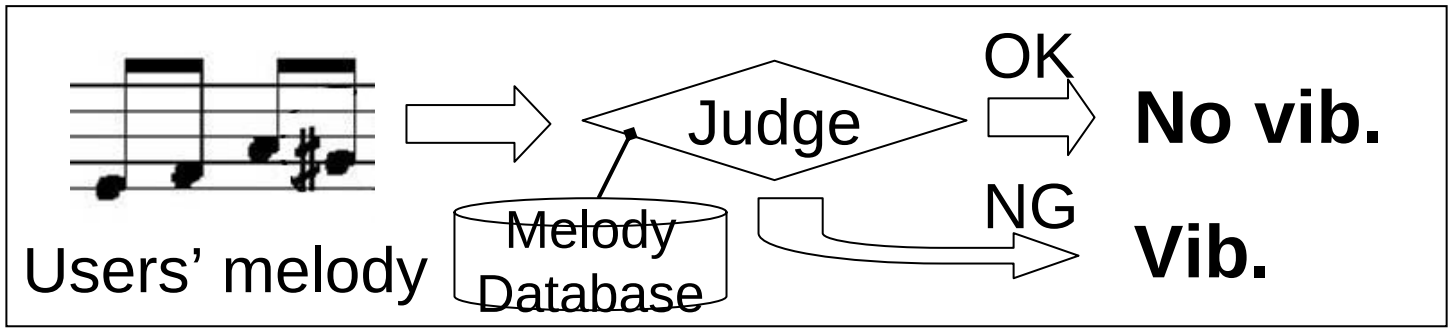
ism: Melody Correction System

- Automatically *corrects* the user's *musically inappropriate* (or unnatural) *notes*
- N-gram-based inappropriate note detection
- Hides inappropriate melodies from listeners
  ⇨ Facilitates *mitigating beginners' hesitation* toward trying improvisation



ism$_V$: Key Vibration System

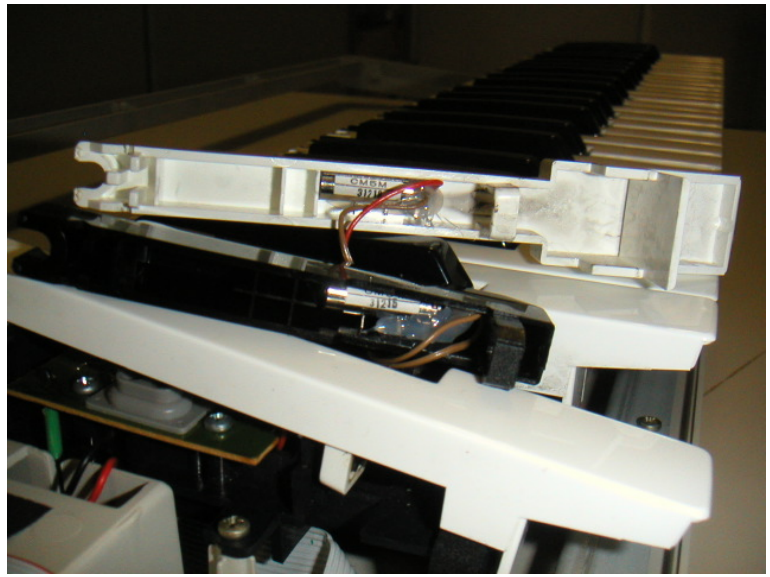
- *Vibrates the corresponding keys* if the user plays musically inappropriate (or unnatural) notes
- N-gram-based inappropriate note detection
- Users can know if their melodies are appropriate
  ⇨ Facilitates learning appropriate melodies and improving their skill of melody creation



ism_V: Key Vibration System

A new weapon:

Buru-Buru-kun,
a new keyboard that has
a built-in vibrating motor
in each key



Why vibration?

- Visual indication ⇨ Eyes kept on the indicator
- Auditory indication ⇨ Disturbs music
- Tangible indication

  ⇨ Users can find it immediately and directly!

cf. Heating keys ⇨ takes time

Inappropriate Note Detection

Problem:

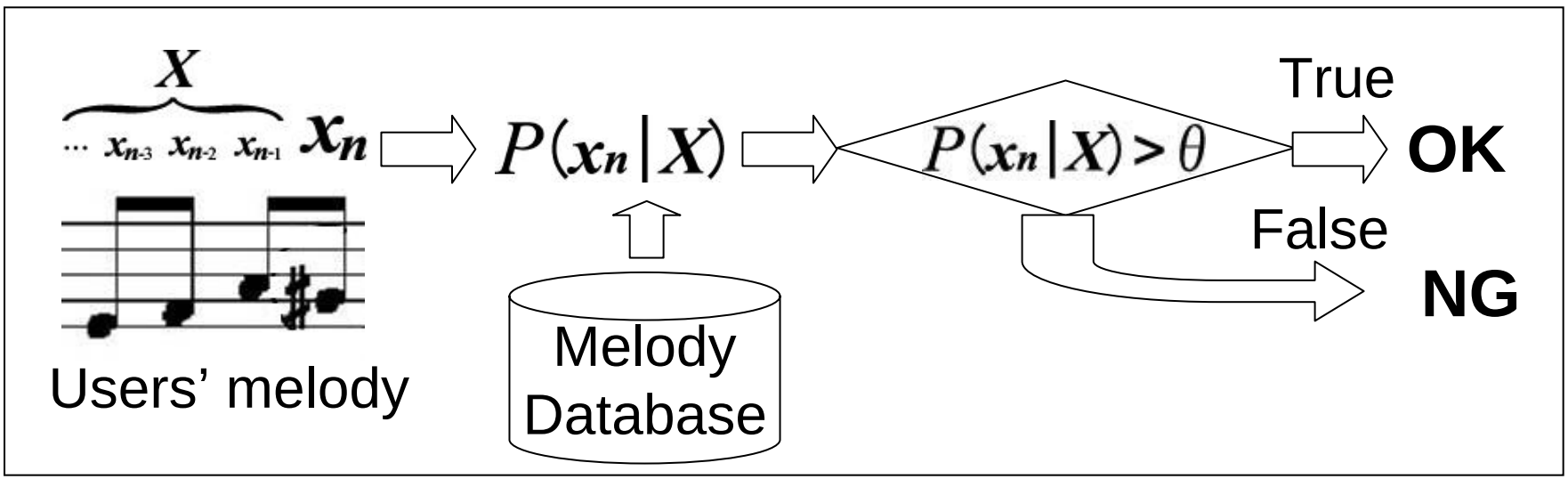
Out-of-scale notes are not necessarily inappropriate

Our solution:

Based on N-gram probabilities in actual melodies

Key idea:

If a note sequence is frequently used in actual melodies, it should be musically appropriate



Evaluations

① Accuracy of inappropriate note detection

② Questionnaire for ***ism***

③ Questionnaire for $\boldsymbol{ism_v}$

① Accuracy of inappropriate note detection

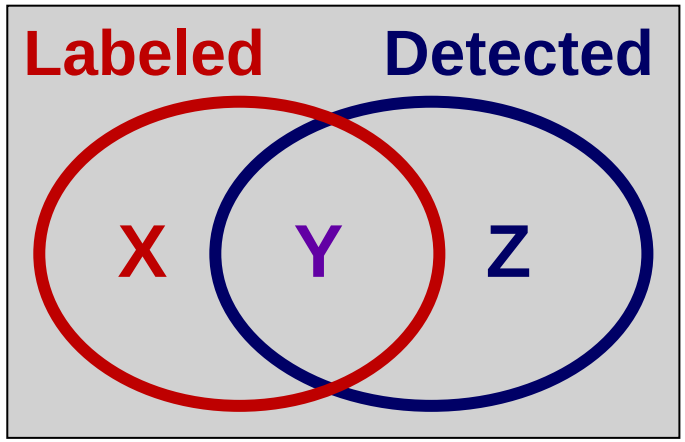
Experimental procedure:

① Collect improvisational melodies
37 players, 64 measure/player, 8,945 notes
(Beginning: 10, intermediate: 15, advanced: 12)

② Label musically inappropriate notes manually

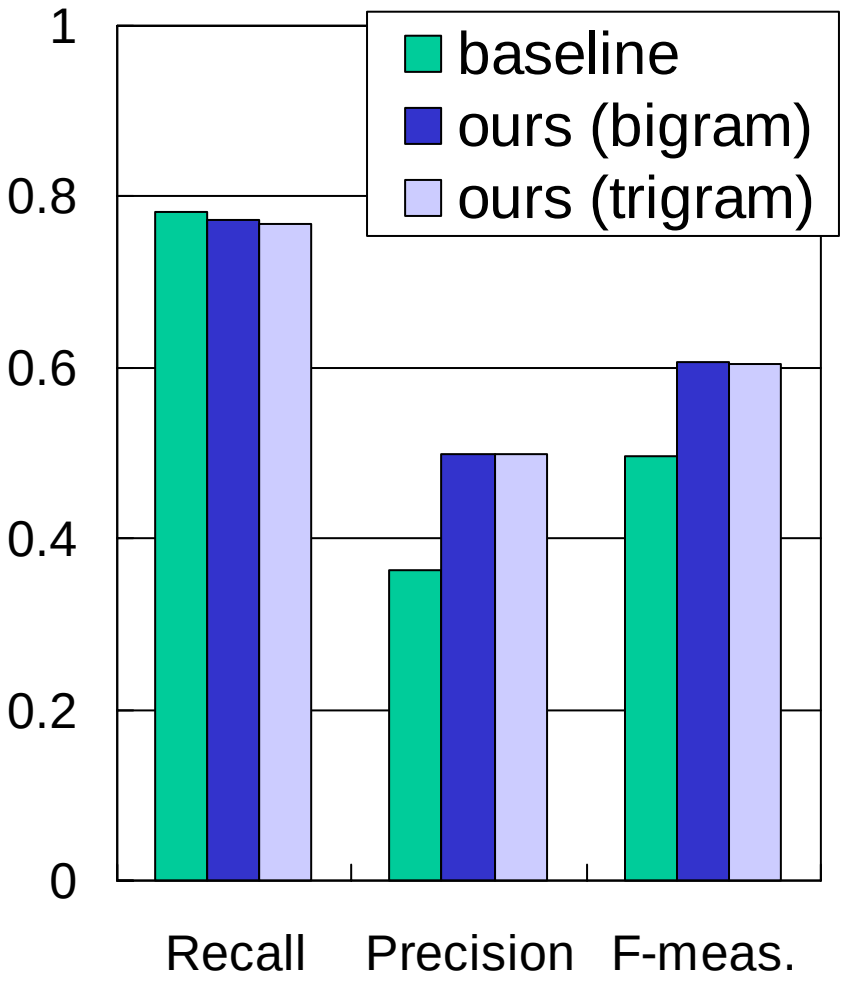
③ Try automatic inappropriate note detection

④ Calculate the following:
Recall rate: **R=Y/(X+Y)**
Precision rate: **P=Y/(Y+Z)**
F-measure: **F=R*P/(R+P)**



① Accuracy of inappropriate note detection

Experimental results:



- F-measure improved
- Precision rate 13% higher while recall rate only 1-2% lower
  ⇨improved “over-detection”
- F-measure for intermediate group was over 0.75

baseline: To simply judge the notes out of the scale to be inappropriate

② Questionnaire for *ism*

Experimental procedures:

Subjects use 3 systems (all-corr, bigram, trigram) and answer questions for each system

Subjects:

3 improvisational beginners

(but they have long experiences in playing instrs.)

Questions:

(Yes) 7-6-5-4-3-2-1 (No)

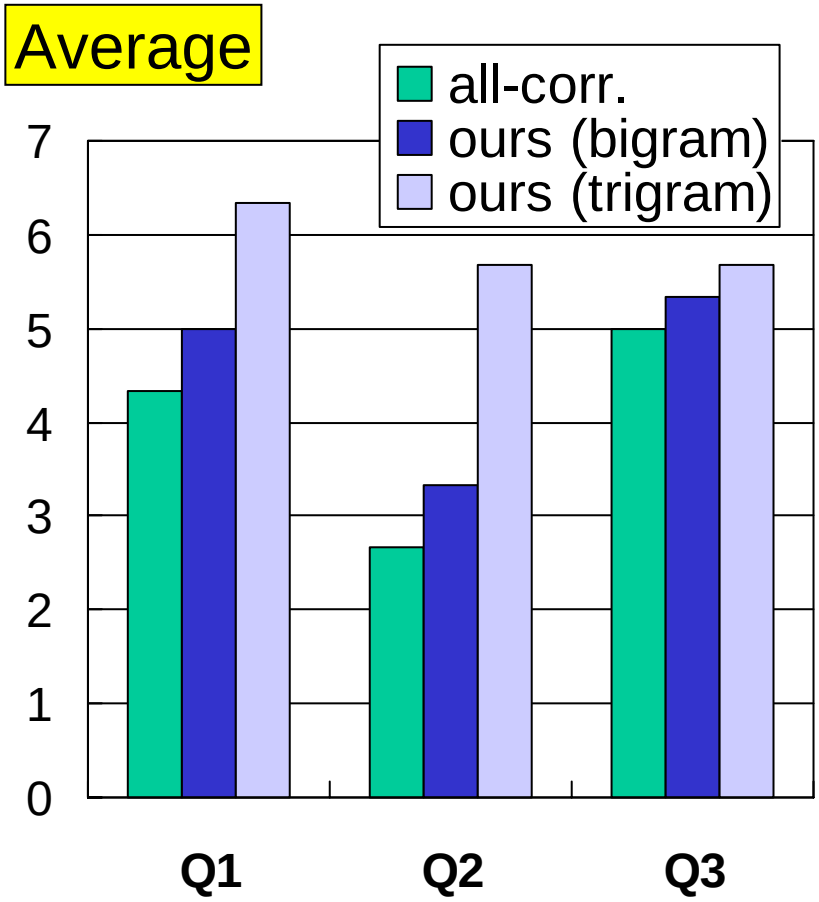
Q1 Do you think the correction was appropriate?

Q2 Did you improvise without feeling a strong sense of strangeness?

Q3 Did you enjoy the improvisation?

② Questionnaire for *ism*

Experimental results:



- Ours superior to *all-corr.* for all questions
- *Trigram* superior to *bigram*
  ⇦ It uses longer sequences
- The result of *trigram* for Q2 high enough
  ⇨ Little strangeness feeling even if experienced players

all-corr: To correct all the notes out of the scale

③ Questionnaire for ism_v

Experimental procedures:

Subjects try improvisation practices
using ***ism*$_v$** and a normal MIDI keyboard, and
answer questions for each practice

Subjects:

16 improvisational beginners

Questions:

（Yes) 7-6-5-4-3-2-1 (No)

Q1 Do you think you can improve your improvisation?

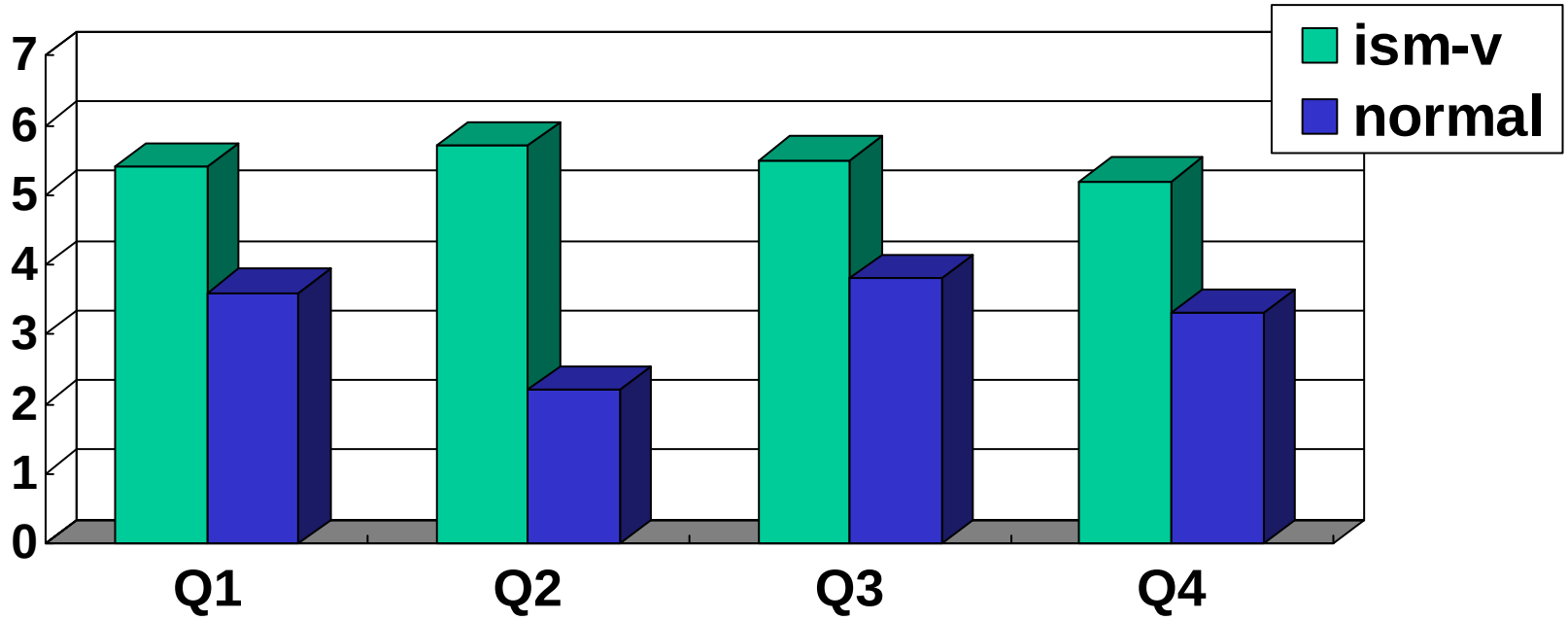
Q2 Do you think this practice is efficient?

Q3 Did you enjoy the practice?

Q4 Do you think you will continue this practice?

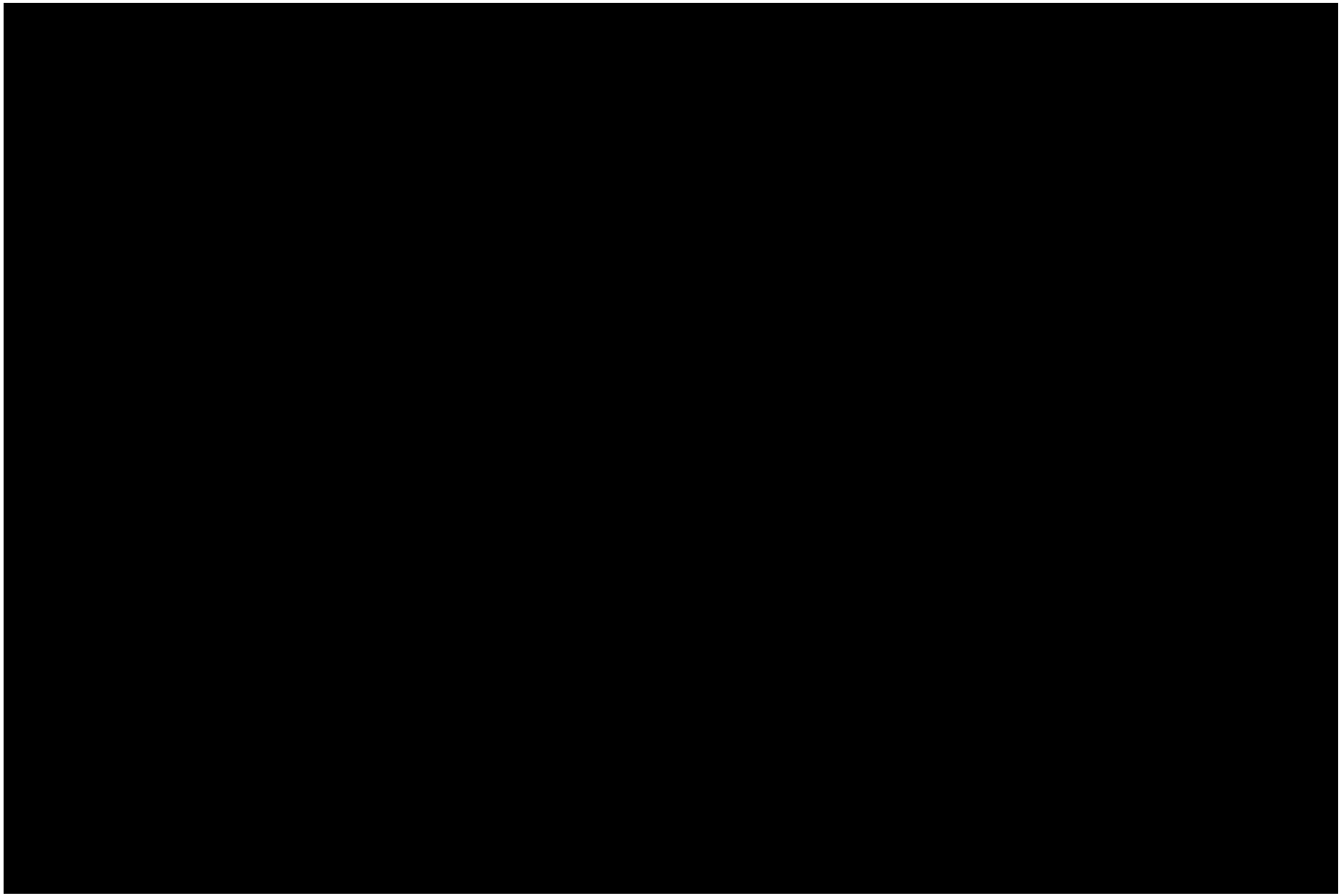
③ Questionnaire for ism_v

Experimental results:



- Results for all questions were over 5.0 on average
- Results of ***ism*$_v$** were 1.7-3.5 higher than *normal*
- Paired t-test show the significance of ***ism*$_v$** with 95%

Demo Video



Conclusions

Aim:

To support skill for improvisation

2 systems for achieving the aim:

- ***ism***: Automatically corrects musically inappropriate notes
  - ⇨ Enhances the skill for melody creation
- ***ism*$_v$**: Points out musically inappropriate notes with key vibration
  - ⇨ Helps improving the skill by themselves

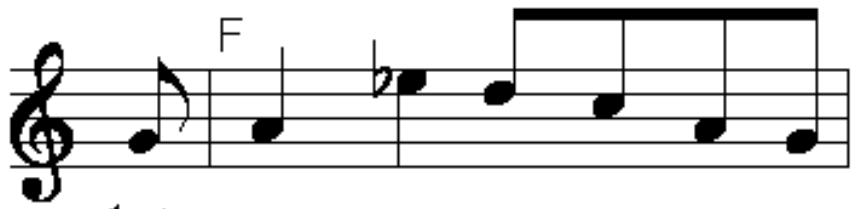
Future work:

Other instruments (e.g. bass), Long evaluation etc.

Features

The following feaures are extracted before N-gram probabilities are calculated:

- The kind of the note (chord tone, key tone, etc.)
- The interval between the note and the last note (m2, M2, more than m3)
- Whether the note is on 8th-note-level beats
- Whether a rest exists between the note and the last note



	1st	Chd	Els	Key	Chd	Chd	Key
2nd	M2	m3	m2	M2	m3	M2	
3rd	T	T	T	F	T	F	
4th	F	F	F	F	F	F	

Chd: chord tone
Key: key tone
Els: Else

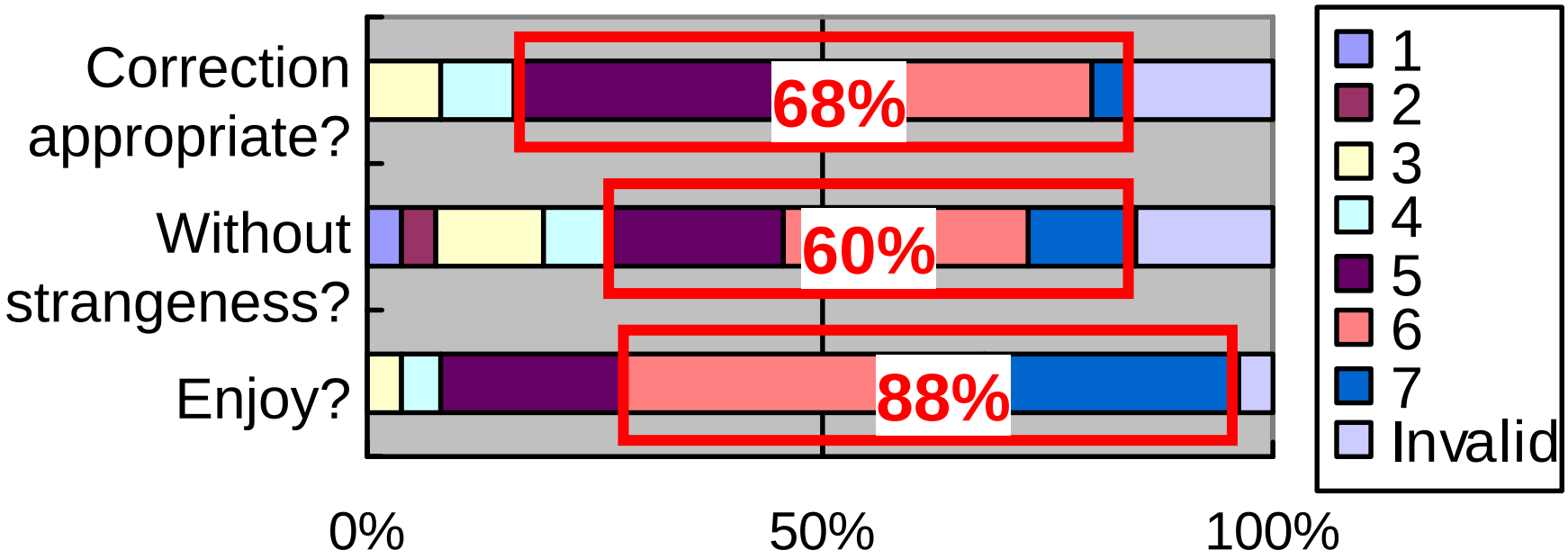
m3: more than m3
T: True
F: False

Demo of *ism* in WISS 2003

WISS (Workshop on Interactive Syst. & Softw.):

One of the biggest domestic workshops on human computer interaction in Japan

25 participants tried ***ism*** and answered questionnaire



Demo of *ism* in WISS 2003

Participants' comments:

- I want to do more improvisation.
- Even if I play it without thinking,
  it produces appropriate melodies.
- This system is good for unskilled people.
- I can enjoy improvisation although
  I am a beginner.
- etc.

③ Questionnaire for ism_v

Subjects' comments:

for ism_v

- I can easily recognize which notes are wrong.
- It's efficient at telling me when my playing is not in line with the accompaniment.
- This is revolutionary.
- etc.

for a normal MIDI keyboard

- It takes long time because I cannot quickly recognize wrong notes.
- Too difficult for beginners.
- This is boring.
- etc.

Related Work

Studies on jam sessions:

- **Jam session systems:**
  constructs virtual musicians in computers
- **Open RemoteGIG:**
  achieves worldwide jam sessions via the Net

  ⇨ Only a few attempts of supporting the skill

Studies on supporting skill for jam sessions:

- **Inspiration:** corrects all out-of-scale notes
- **Theremoscore:** heats out-of-scale keys
- **RhyMe:** uses a new note-key mapping based on functions of notes

Future Work

- To Apply our concept to other instruments
  e.g. guitar, bass
- Long-period experiments on esp. ***ism$_v$***
  ---How well can users improve their skill by using ***ism$_v$*** for e.g. 1 year?---
- To integrate our systems with OpenRemoteGIG
  ---Users can enjoy jam sessions with worldwide musicians through the Internet even if they are beginners---