Preserving plucked string interaction technique in accessible instruments

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Outline

*Preserving **plucked-string interaction** in **accessible instruments***

*Background: **accessible string instruments** & **plucked string technique***

*Two instrument studies: **Adapted Bass Guitar** & the **Strummi***

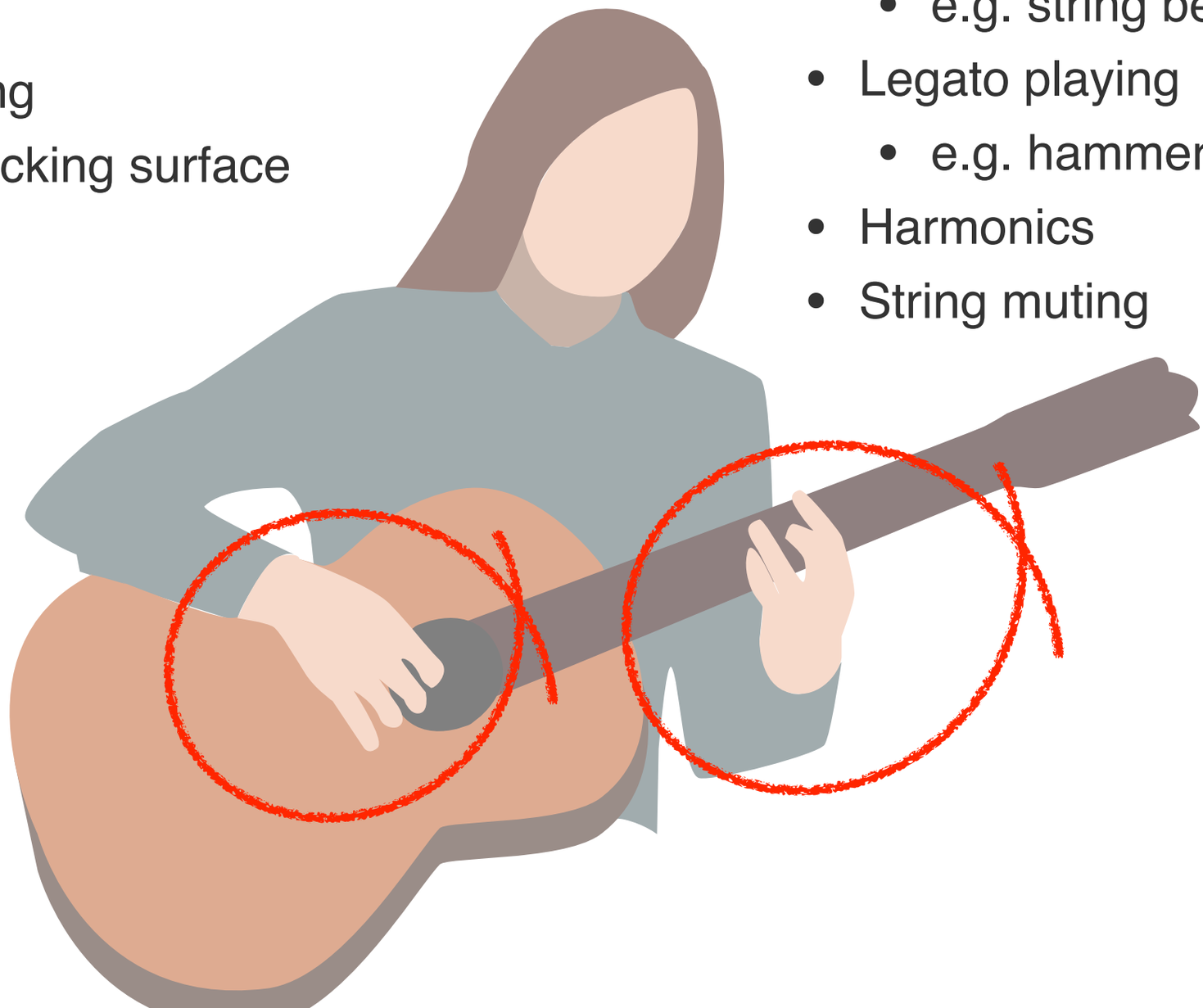
Study findings and reflections

Background

Background - Plucked String Interaction

Plucking/Note activation:

- Timbre
- Dynamics
- Timing
- String muting
- Material/plucking surface



Fretting/Note selection:

- Note choice
- Expression following note onset
  - e.g. string bending, vibrato
- Legato playing
  - e.g. hammer-on/pull-off/slide
- Harmonics
- String muting

Approaches to accessible string playing

Approaches to accessible string playing

The Actuated Guitar

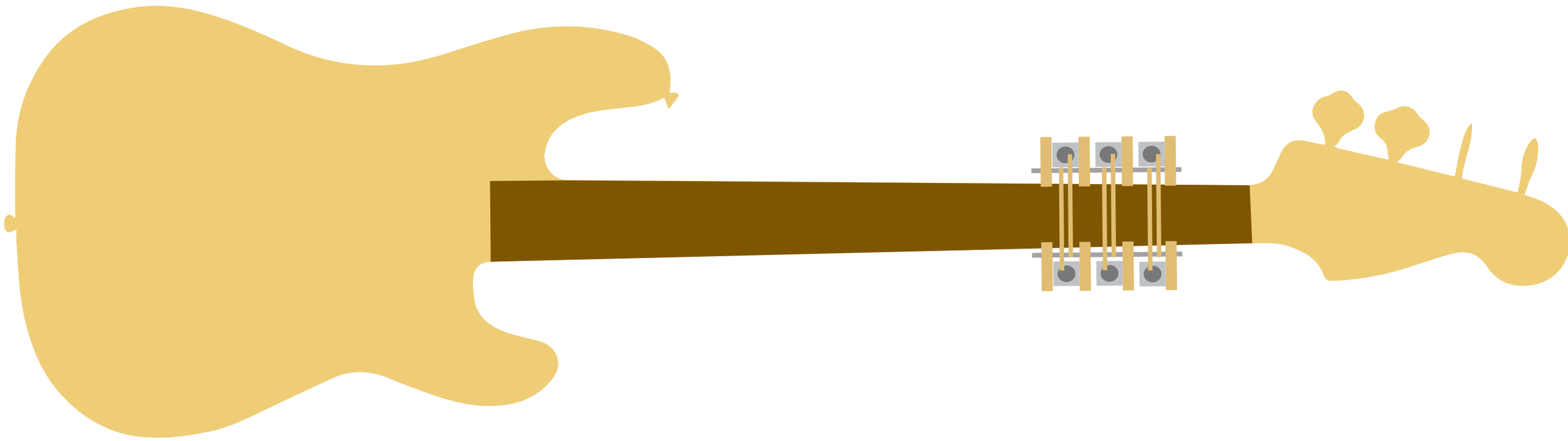
Jeppe Larsen et al.

Approaches to accessible string playing

Approaches to accessible string playing

Approaches to accessible string playing

The Adapted Bass Guitar



The Adapted Bass - Instrument Design

- Designed in collaboration with the **OHMI Trust**
- Design brief: to make an instrument to submit to the OHMI competition
- Explicit goal to design a bass guitar **playable without the use of one hand and arm**
- Secondary goals:
  - Maintain separation of note selection (fretting) and note activation (plucking)
  - Preserve acoustic strings, look and ‘feel’ of bass guitar

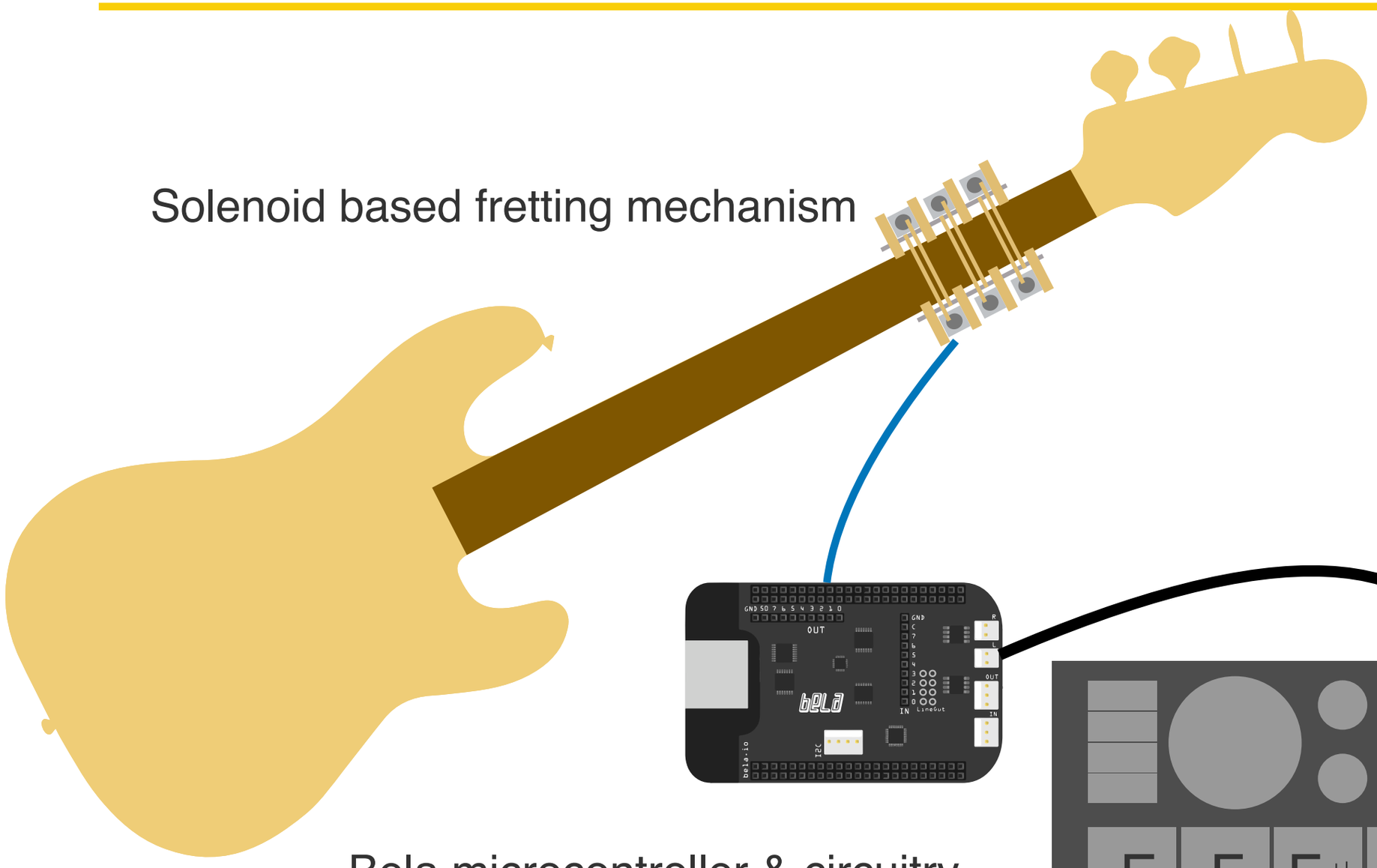
The Adapted Bass - Instrument Design

- Survey of bass guitar players
  - Aim: to establish the roles of the **fretting** and **plucking** hands in bass performance, and their importance in relation to various elements of bass playing
  - Online survey: **48 respondents**
  - **Rhythmic accuracy, choice of rhythm, note choice**, were the most important performance elements
  - **Fretting hand articulation** and **use of effects** among the least important
  - **“groove”**, **“feel”** and **“timing”** were common terms used in the free text comments
  - **Plucking hand** most important to players’ style and expression (52%) compared with **fretting hand** (23%) or **both hands** (23%)

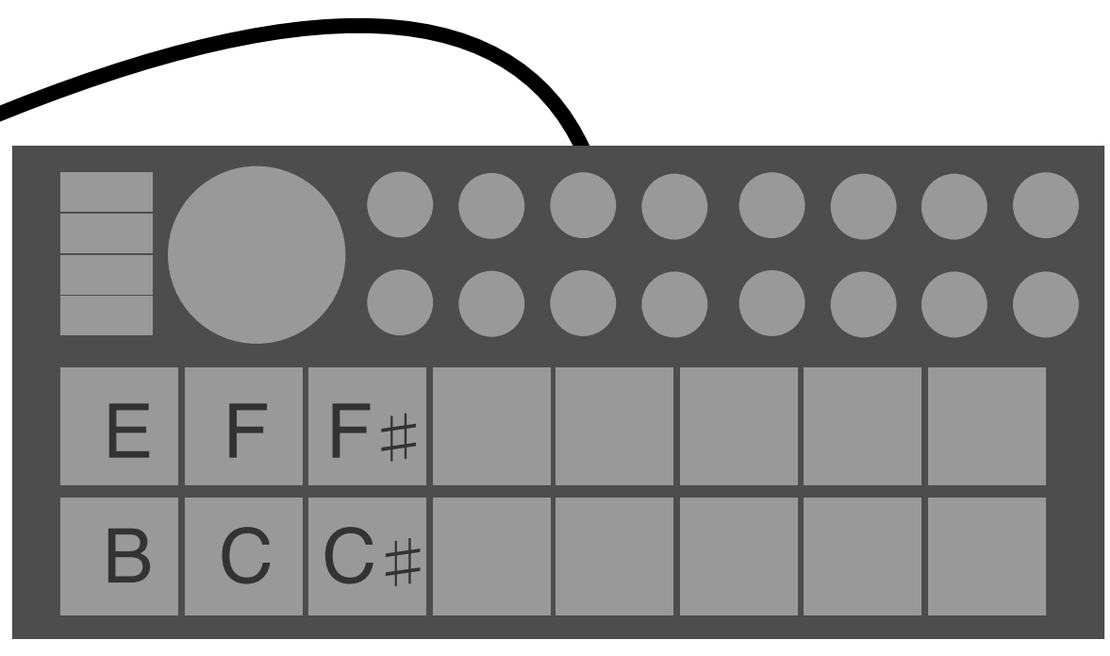

BEATSTEP

The Adapted Bass - Instrument Design

Solenoid based fretting mechanism



Bela microcontroller & circuitry



MIDI controller assigned to frets

The Adapted Bass - User Study

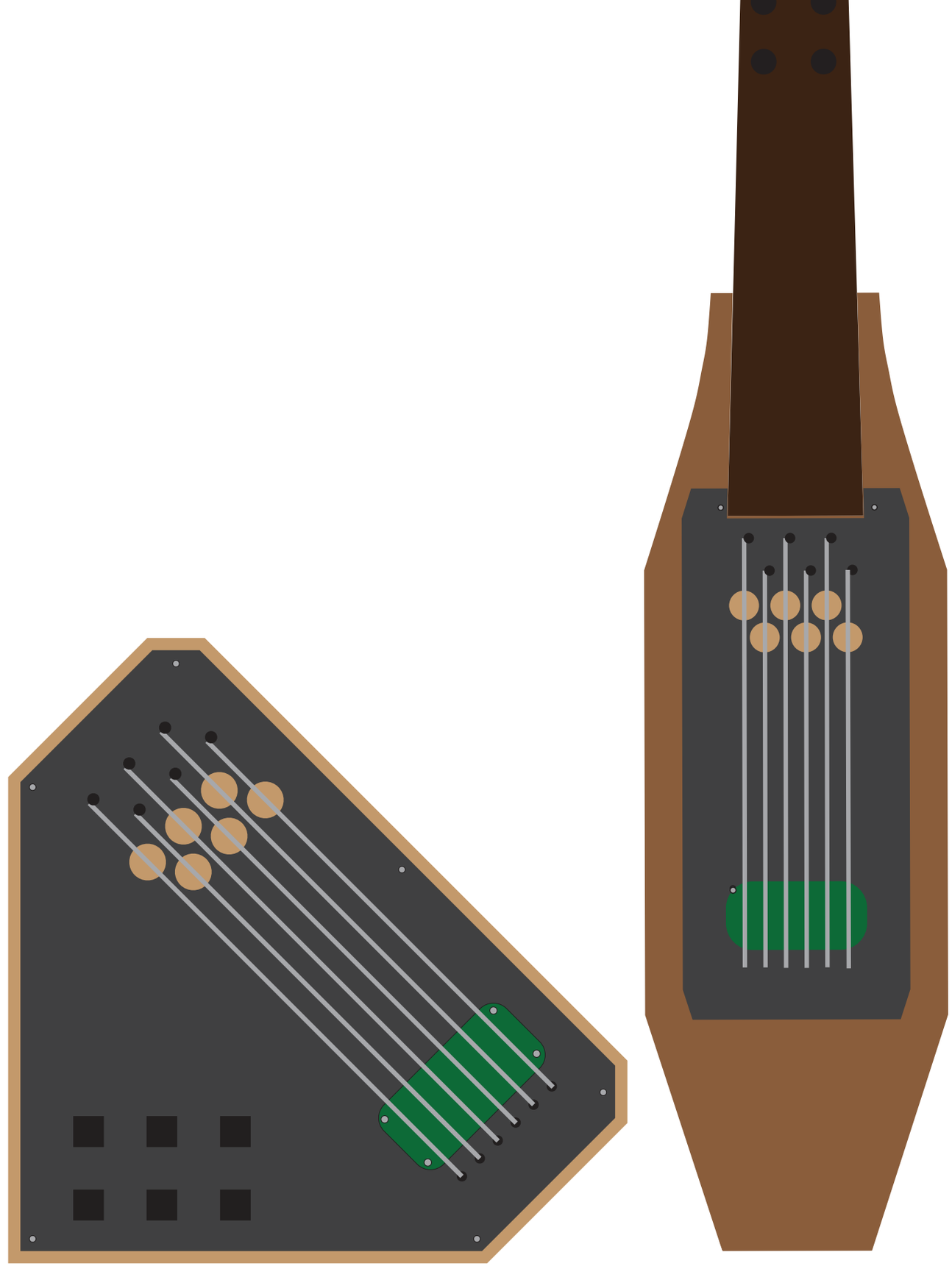
- Aims:
  - To evaluate the adapted bass as a **usable musical instrument**
  - To observe the effects of **transferring the role** of the fretting hand onto an **alternate limb**
- Participants
  - Six males with 15-30 years of musical experience (5-17 years spent playing bass)
  - Non-disabled musicians
  - Recruited from C4DM
- Study format
  - Rehearsal with the instrument (>2 hours over 3 weeks)
  - Performance to a 1 min backing track
  - Filmed and annotated, followed by questionnaire

Harrison, J. and McPherson, A.P., 2017. Adapting the Bass Guitar for One-Handed Playing. *Journal of New Music Research*, *46*(3), pp.270-285.

The Adapted Bass - Findings

- Overcoming **limitations** of the system:
  - Use of open strings as passing notes - minimise foot movement
  - String muting
    - Fretting mechanism not capable of lightly pressing on string
    - **Functional mutes** transferred to plucking hand (e.g. for staccato, timing)
    - Palm-muting with plectrum used as **functional adaptation/ stylistic choice**
- **Affordances** of the system:
  - Strong/rapid hammer-ons

The Strummi



The Strummi - Instrument Design

- PhD study in collaboration with Robert Jack
  - Focus on the effect of **form** and **interaction modality** on perceived authenticity (*'guitariness'*)
  - Form: **guitar-shaped** vs. **tabletop**
  - Interaction: **physical strings** vs. **touch sensor**

Harrison, Jacob, Robert H. Jack, Fabio Morreale, and Andrew McPherson. "When is a Guitar not a Guitar? Cultural Form, Input Modality and Expertise." In *Proc. NIME*. 2018.

Jack, Robert H., Jacob Harrison, Fabio Morreale, and Andrew McPherson. "Democratising DMIs: the relationship of expertise and control intimacy." NIME, 2018.


TG - Touch Guitar

The Strummi - Instrument Design

- Six dampened guitar strings
  - **Karplus-strong** virtual string model
  - Two modes: **sample-triggering** and **audio-rate excitation**
  - Audio-rate excitation: finger-picking, strumming with plectrum, tapping, scraping, bowing
- Touch version: sample-triggering only
- Six chord buttons: C, G, D, Am, Em, Bm

The Strummi - User Study

- Participants
  - Two groups: **competent guitarists** and **non-musicians** (Self-reported guitar experience)
  - 16 competent guitarists, 16 non-musicians
- Study format
  - Comparison of two of four instrument variations
  - Free improvisation + performance to a backing track
  - Recorded structured interview
  - On-screen questionnaire

The Strummi - Findings

- **Authenticity** of experience:
  - Guitarists noted **familiarity** of strings
  - Both groups recognise the **guitar form** as most guitar-like
  - **Social role** of instruments
- **Richness** of interaction:
  - Non-musicians tended to prefer **sample-triggering**
  - Guitarists preferred **audio-rate excitation**
- Touch sensor encouraged keyboard/tablet style gestures (tapping/swiping)

Discussion

- Presence of real strings important for **authenticity**
  - **Correspondence** between action and sound
- Separation of note **selection** and **activation**
  - Transferral of note selection to alternate limb/control scheme
- When is a guitar not a guitar?
  - **Addition/removal** of features/affordances
  - **Preservation** of salient components: timing, rhythm, mode of interaction
  - **Adaptation** of technique

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