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Recent advances in extended reality (XR) technologies make seeing and hearing virtual objects commonplace, yet strategies for synthesizing haptic interactions with virtual objects continue to be limited. Two design principles govern the rendering of believable and intuitive haptic feedback: movement through open space must feel "free" while contact with virtual objects must feel stiff. Herein, a novel multisensory approach that conveys proprioception and effort through illusory visual feedback and refers to the wrist, via a bracelet interface, discrete and continuous interaction forces that would otherwise occur at the hands and fingertips, is presented. Results demonstrate that users reliably discriminate the stiffness of virtual buttons when provided with multisensory pseudohaptic feedback, comprising tactile pseudohaptic feedback (discrete vibrotactile feedback and continuous squeeze cues in a bracelet interface) and visual pseudohaptic illusions of touch interactions. Compared to the use of tactile or visual pseudohaptic feedback alone, multisensory pseudohaptic feedback expands the range of physical stiffnesses that are intuitively associated with the rendered virtual interactions and reduces individual differences in physical-to-virtual stiffness mappings. This multisensory approach, which leaves users' hands unencumbered, provides a flexible framework for synthesizing a wide array of touch-enabled interactions in XR, with great potential for enhancing user experiences.

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1. Introduction

Over the past decade, advances in optics, displays, graphics, tracking, environment mapping, and audio have revolutionized technologies for extended reality (XR). The scope of XR has exploded in recent years, with applications spanning education, marketing, and remote work, as well as training for medicine, industry, and military.^[1] All-day wearable XR displays are likely to reinvent computer interfaces in ways that rival the smartphone and personal computer, dramatically changing the way we interact with both the digital and physical worlds, as well as with other people. As we move toward a future in which seeing and hearing virtual objects is commonplace, we must also consider another important sensory aspect-touch.

The sensation of touch is critical to our ability to interact with objects in the virtual world just as it is in the physical world, yet there remain significant challenges in synthesizing believable haptic interactions. The earliest haptic device designers proposed that for interactions to feel realistic,

the haptic device must make free space feel free and must render stiff virtual objects.^[2] These objectives led to the development of probe-based devices that exhibited low inertia and little to no backlash in their transmission mechanisms, and required anchoring to desktop surfaces so that world-grounded stiffnesses and resistance could be rendered to the user. XR haptic device designers are presented with yet more challenges. XR devices not only need to meet free space and stiffness criteria but must do so in an ungrounded, low encumbrance manner. So far, most efforts have focused on wireless haptic controllers,[3-5] fingertip displays,^[6] and haptic gloves.^[7] While these devices address the free-space consideration, they often cannot render virtual stiffnesses and, critically, prevent or degrade concurrent interaction with physical objects in all-day XR contexts. Soft, skin-like materials and devices may show promise in this way, imposing negligible physical burden on users, while delivering reliable sensations and sufficient forces to the skin^[8–10]; however, much of this technology is still under development and further from implementation.

How can we render virtual stiffnesses without being grounded to the world or encumbering the hands? One method that has



been proposed is visual pseudo-haptics. In contrast to delivering mechanical stimulation, visual pseudo-haptics use visual, spatial, or temporal illusions to convey the sense of touch.^[11] Using head mounted displays (HMDs), these methods often amount to creating an artificial discrepancy between the user's rendered and actual hand locations. Doing so has been shown to invoke sensations such as stiffness, mass, and friction and is hypothesized to function based on manipulating the user's perception of work or exerted effort.^[12] While visual pseudo-haptic effects can deliver proprioceptive and kinesthetic cues of stiffness without grounding the user, they obviously lack true tactile and force-feedback cues that are necessary for believable haptic feedback. Naturally, some researchers have combined visual pseudo-haptic cues with tactile haptic interfaces,^[13,14] but these approaches still display the issues of hand encumbrance and limited applicability to all-dav XR.

In this article, we present a novel approach-multisensory pseudo-haptics-to realizing haptic interactions in a virtual environment that combines visual pseudo-haptic feedback with tactile pseudo-haptics, achieved by applying haptic feedback at the wrist for cues normally felt at the fingertips. We use Tasbi,^[15] a wearable haptic bracelet that provides a continuous squeeze force radially around the wrist, coupled with distributed vibration cues, to convey sensations, forces, and transients that would otherwise be expected at the hands and fingertips. Our proposed multisensory pseudo-haptic approach addresses the two primary design objectives of grounded haptic devices introduced nearly three decades ago,^[2] namely that free space must "feel free" (achieved via a wearable bracelet) and that solid virtual objects must "feel stiff" (achieved via a clever combination of discrete and continuous visual and tactile pseudo-haptics). Rendering haptic feedback in an indirect or referred manner at a site located away from the hand overcomes the encumbrance issues that handheld, glove-type, and fingertip devices have, but may result in the loss of fidelity of the haptic experience and reduction of

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haptic cue saliency since the density of mechanoreceptors at the wrist is much less than that at the fingertips and other areas of the hands.^[16] The inclusion of continuous squeeze cues at the wrist has the potential to enhance the haptic experience of users compared to visual-only feedback, supplementing the proprioceptive nature of the interaction rendered via visual pseudo-haptics with continuous tactile haptic sensations that are coordinated with user actions.

We hypothesize that multisensory pseudo-haptics, combining tactile wrist-based pseudo-haptics and visual pseudo-haptics, may induce genuine perceptions of users' virtual interactions, beyond just metaphors for haptic feedback. Further, this approach offers a way to balance the encumbrance issues of current haptic wearables with the lack of touch sensations in visual pseudo-haptic renderings. To this end, we first describe our approach for achieving believable mid-air haptic experiences, all while keeping the hands free. Then, in two psychophysical studies, we show that users map this multisensory sensation to physical object stiffness, and that users can discriminate the stiffness of different virtual interactions that are modulated through the parameters of the pseudo-haptic and referred haptic feedback renderings. Our approach provides a framework for creating a wide array of touch-enabled interactions in XR, with great potential for enhancing user experiences.

2. Results

2.1. Multisensory Mid-Air Interaction Paradigm

The primary contribution of this paper is a hands-free, haptic feedback paradigm for XR interaction that combines tactile pseudo-haptic feedback (squeeze and vibrations) from a bracelet with visual pseudo-haptic feedback delivered via an HMD. **Figure 1** provides an explanation of how we combine multisensory pseudo-haptic cues to create a believable interaction of



Figure 1. Multisensory pseudo-haptic paradigm applied to a mid-air button interaction. The top row represents the virtual interaction, while the bottom row depicts the respective motion of the user in physical space. A) The user approaches the button. The control hand (blue) and display hand (black) are initially collocated. B) The user makes initial contact with the button. Tasbi's linear resonant actuators (LRAs) render a vibration to simulate the contact event. C) The user begins to push the button downward. Tasbi squeeze force increases proportionally to the button displacement and spring force. The control hand continues to track the user's true hand position and orientation, while the display hand remains on the surface of the button. D) At the end of travel, squeeze reaches its maximum (desired) force level, and the C/D discrepancy has become more pronounced. Note that the blue control hand is shown in these figures only for illustrative purposes and is not displayed to users.



pressing a "stiff" virtual button. As the user's hand approaches the virtual button, the rendered hand (the display) and the actual hand (the control) are collocated (Figure 1A). Using terminology from the classic "god-object" rendering method,^[17] the rendered (display) hand is the god-object, and the user's hand (control) is the haptic interface point. Note that the user cannot see the blue control hand in practice. When collision is detected between the button and fingertip, a vibration stimulus is rendered through the bracelet to simulate the contact event (Figure 1B). As the user depresses the button (Figure 1C), we manipulate the location of the rendered hand such that it lags the actual hand by a proportional amount parameterized by the control-to-display ratio (C/D), thus providing the sensation of impeded motion. Simultaneously, we deliver increasing squeeze forces through the wristband to convey the resistive spring force of the button. As the user reaches the end of button travel (Figure 1D), the C/Ddiscrepancy and squeeze intensity reach their maximum (desired) values, and a vibration stimulus is rendered to depict the button hard stop or activation event. Specific details regarding our implementation of the visual pseudo-haptics (C/D manipulation) and tactile pseudo-haptics (squeeze and vibration) can be found in the Experimental section.

When combined, the visual and tactile pseudo-haptic cues deliver a believable sensation of pressing a stiff button, despite the interaction occurring in entirely free space with no feedback delivered to the hand or fingertip. Notably, we predict that no visual or tactile pseudo-haptic cue can lead to compelling feedback alone, but instead highly believable substitutive feedback for mid-air interactions with virtual objects will depend on their multisensory combination. To understand if this multisensory pseudo-haptic combination invokes believable perception of virtual objects, we devised two psychophysical experiments, presented in the following sections.

2.2. Experiment 1: Estimating Absolute Stiffness

Here, we sought to identify whether individuals map virtual button stiffness—conveyed through tactile or visual pseudo-haptics—to physical stiffness measured using a real button. We also

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sought to determine whether stiffness mappings differed when virtual stiffness was conveyed via multisensory pseudo-haptic cues compared to tactile pseudo-haptic or visual pseudo-haptic cues only. Our first experiment (Figure 2) tasked subjects (N = 12) with adjusting the stiffness of a physical button until it was perceptually equivalent to the stiffness of a virtual midair button. The mid-air button could be in one of the three conditions: Tactile-only (T; i.e., tactile pseudo-haptics comprising squeeze and vibration), Visual-only (V; i.e., visual pseudo-haptics via C/D manipulation only), or Tactile-Visual (TV; i.e., multisensory pseudo-haptics). Each condition was tested in separate blocks, beginning with a series of repeated pretest trials, and followed by a series of test trials where repetitions of 4 virtual stiffness levels (mapped to squeeze forces or C/D ratios) were presented in random order. Displacement and force plots obtained from representative trials for each condition can be found in Figure S3, Supporting Information.

Subjects reliably matched the stiffness of a physical button to the stiffness of a mid-air button. As squeeze force or C/D ratio increased, participants tended to adjust the physical button to have greater stiffness (**Figure 3**A–C). A two-way repeated measures analysis of variance (ANOVA) on the adjusted stiffness values revealed significant main effects of condition (F(2,22) = 3.6, p = .043) and level (F(3,33) = 211, p < .001) as well as a significant condition X level interaction (F(6,66) = 6.2, p < .001). These results indicate that the matched stiffness values differed between the T, V, and TV conditions, and these differences varied as a function of level.

Given the significant interaction between condition and level on matched stiffness values, we fit a linear function to each subject's data to quantify behavior under the T, V, and TV conditions (Figure 3D–F). The slope parameter for the linear functions describes how physical stiffness varies as a function of virtual stiffness in each condition. The linear functions generally provided a good description of the stiffness reports (mean R^2 : .91 ± .15) which increased monotonically as a function of level. Linear function fits were better for the TV condition (.97 ± .03) compared to the T condition (.81 ± .22; p = .021), but not the V condition (.95 ± .06; p = .15) (Figure 4B). These results



Figure 2. Experiment 1 overview. A) Subjects were presented with two buttons—a virtual, mid-air button rendered through visual pseudo-haptics and/or tactile pseudo-haptics, and a physical button rendered through a custom apparatus collocated with the virtual environment. B) Subjects increased or decreased the stiffness of the physical button with the controller thumb stick until it was perceptually equivalent to the virtual button, which was held at constant stiffness for each trial. Subjects were allowed to transition freely between buttons within the 20 s time limit.

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Figure 3. Experiment 1 main results (N = 12). A–C) Box plots of subject mean responses in each level for each condition (outliers are beyond 1.5 IQR). We observe an increase in stiffness responses given an increase in wrist squeeze and/or visual C/D stimuli. D–F) Mean responses and fits for individual subjects as well as the group level fit for each condition (error bars are a 95% confidence interval). G–I) Subject residuals from the group level fit, where we find smaller residual values in the TV condition. This suggests that individual differences are reduced when congruent visual and tactile pseudo-haptic cues are provided.



Figure 4. Experiment 1 metrics (N = 12). A) Slopes obtained from the linear fits to subject level means. Slopes in the bimodal condition were significantly greater from those found in the unimodal conditions, indicating that bimodal feedback extends the range of stiffness that can be rendered. B) The quality of fit, R^2 , obtained from the same fits. C). The square of residuals from the group-level fit, collapsed across level. Significantly smaller residuals in the bimodal condition suggest that subjects were more consistent with each other in this condition compared to the unimodal conditions. All error bars represent a 95% confidence interval.



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imply that the mapping between virtual and physical stiffness is linear when multisensory pseudo-haptics are used, but this linearity breaks down when only tactile pseudo-haptic cues are available. Estimated slopes also differed between conditions (T: 37.8 ± 19.9 ; V: 45.8 ± 15.4 ; TV: 57.1 ± 11.4) (Figure 4A). The significantly larger slopes in the TV condition compared to the T condition (p = .013) and V condition (p = .020) imply that the combined use of tactile and visual pseudo-haptic cues expanded the range of physical stiffnesses that could be associated with the rendered virtual cues.

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We next determined whether the unimodal and bimodal virtual stiffness cues influenced across-subject consistency in stiffness mappings. Visual inspection of estimated stiffness values under each condition (Figure 3) reveals substantially less individual variability in the TV condition compared to the unimodal conditions. To quantify this relationship, we considered how each subject's data deviated from the group-level linear fit in each condition (Figure 3, bottom row). A two-way repeated measures ANOVA on squared residuals showed significant main effects for level (F(3,33) = 7.4, p = .003) and condition (F(2,22) = 8.1, p = .003)p = .012). Post hoc analyses (Figure 4C) showed significantly lower residual errors in the TV condition compared to the T condition (F(1,11) = 10.3, p = .008) and the V condition (F(1,11) = 17.5, p = .002). We evaluated how residual errors varied as a function of level in each condition (Figure 3G-I). We observed a greater dispersion in the residual errors as a function of stiffness level in the T condition (F(3,33) = 3.05, p = 0.05) and V condition (F(3,33) = 4.60, p = .04), but residual errors did not differ across levels in the TV condition (F(3,33) = 0.65, p = .53). These collective results imply that the combined use of tactile and visual pseudo-haptic cues leads to greater uniformity in the mapping between virtual and physical stiffness.

2.3. Experiment 2: Discriminating Virtual Stiffness

The results of Experiment 1 indicated that subjects could map virtual stiffness cues—rendered through tactile pseudo-haptics and visual pseudo-haptics, individually or in combination—to the stiffness of a physical button. In Experiment 2 (Figure 5), we determined whether subjects could discriminate between the virtual stiffnesses of two mid-air buttons using the unimodal or bimodal virtual stiffness cues. In a 2-alternative forced choice (2AFC) paradigm, subjects pressed two mid-air buttons on each trial and reported the one that was perceived to be of a greater stiffness. On each trial, one button was always rendered at a standard stiffness level, and the other button was rendered at a comparison stiffness level that varied from low to high. Comparison stiffness values, chosen to equate the perceived stiffness of the T and V cues, were determined from the group-level fits from Experiment 1 (see Figure S1, Supporting Information). Displacement and force plots obtained from representative trials for each condition can be found in Figure S4, Supporting Information.

Subjects reliably discriminated the stiffness of mid-air buttons (Figure 6), and their performance was captured by a standard psychometric function ($R^2 = .96 \pm .05$) that allowed us to quantify subjects' bias and discrimination thresholds under each condition. Discrimination thresholds (just noticeable difference, IND) differed significantly depending on whether the virtual stiffness was rendered using tactile pseudo-haptics, visual pseudo-haptics, or both modalities (Figure 7A) (F(2,20) = 5.5, p = .019). In general, discrimination thresholds were smaller with bimodal stiffness cues compared to the unimodal cues. Indeed, JND values in the TV condition were significantly lower compared to the JND values in the V condition (p = .007). The difference between JND values in the TV and T conditions did not achieve statistical significance (p = 0.07) despite the qualitative differences. JND values in the T condition did not differ significantly from JND values in the V condition (p = 0.67). No significant differences were found comparing the point of subjective equality (PSE) values between conditions (F(2,20) = 2.74, p =.09). These results indicate that the combined use of tactile and visual pseudo-haptic cues results in finer sensitivity to stiffness variations with minimal impacts to bias.

Given the reduction of discrimination thresholds in the TV condition, we assessed how overall performance compared between conditions. Consistent with the JND effects, we found a significant effect of condition for the percentage of correct responses (F(2,20) = 8.879, p = 0.002) (Figure 7B). Post hoc tests



Figure 5. Experiment 2 overview. A) Subjects were presented with two virtual buttons which were both rendered through either visual pseudo-haptics and/or tactile pseudo-haptics. One button, either left or right, was the standard stiffness, and the other button was the comparison stiffness. B) Subjects were allowed to press each button twice, in whichever order they preferred, before selecting the stiffer of the two buttons using the controller thumb stick.

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Figure 6. Psychometric curves obtained from Experiment 2 (N = 11). (left) Psychometric curves fit to individual subject data in each of the conditions. The central black curves represent the aggregate psychometric curves, i.e., the curve when fitted to all subjects' data. Note the tighter grouping of fits in the TV condition. (right) The aggregate psychometric curves with the mean of all subjects' responses at each stimuli level shown as markers. We can visually observe a greater slope in the TV condition, indicative of a smaller difference threshold.



Figure 7. Experiment 2 metrics (N = 11). A) The mean just noticeable difference threshold for each condition. Subjects were most sensitive to differences in virtual stiffness in the bimodal TV condition. B) The percentage of times subjects correctly selected the stiffer button. C) The square of the residuals between the subject mean responses and the aggregate psychometric fit. As in Experiment 1, this suggests individuals are more consistent with each other when receiving congruent tactile and visual pseudo-haptic cues. Error bars denote a 95% confidence interval.

revealed that subjects achieved significantly higher performance in the TV condition compared to the V condition (p = .002). Although performance in the TV condition was nominally higher compared to the T condition, this difference was not statistically significant (p = .056). No performance differences were found comparing the T and V conditions (p = 0.32).

In Experiment 1, multisensory pseudo-haptics yielded stiffness mappings that were more consistent across subjects

compared to unimodal cues. Discrimination performance in Experiment 2 (Figure 6) followed a similar pattern with a greater uniformity of response profiles in the TV condition compared to the T and V conditions. We tested this by quantifying how each subject's performance deviated from the group-averaged psychometric function in each condition. Across subjects, the sum of squared residuals in each condition differed significantly (F(2,240) = 6.3, p = 0.005) (Figure 7C). Post hoc tests showed



that residual errors in the TV condition were significantly smaller than residual errors in the T condition (p = 0.002) and the V condition (p = 0.002). Residual errors did not differ between the T and V conditions (p = 0.69). These results imply that discrimination performance was more uniform across subjects when virtual stiffness was rendered using bimodal cues compared to tactile or visual pseudo-haptic cues alone.

In Experiment 2, a short survey was presented at the end of each block. The questions, listed in **Table 1**, highlighted subjects' disposition toward the buttons presented in that block. Subjects responded to these questions using a continuous slider on a scale of Strongly Disagree (0.0) to Strongly Agree (1.0). The same questions were presented after each block, with the order randomized. The survey results presented in **Figure 8** show that subjects rated the TV button higher in terms of its believability, pleasantness, and naturalness of interaction. Subjects indicated that the TV and V buttons were roughly equivalent in terms of realism and higher than the T button. Intuitiveness of interaction was positive for all three buttons, with the TV button rated

Table 1. Experiment 2 survey questions. Questions were presented at the end of each of the three condition blocks. Subjects responded on a continuous scale from strongly disagree (0.0) to strongly agree (1.0). Results are shown in Figure 8.

No.	Keyword	ሀ恢ධрቶم‼ വ霩ඉمஏ೭ഐːْೆධ৭ग ។႕႕गဓဓඉവഐ3 ぃ 服ឥයဓةΣഐවمምनچ财 ऱþ^י הمஆកചൢ์ဓچ>ဘF ഐ 当طíឋථវó゠ەଛයהքְ ධہڈធଟ೭íටဓ਼áៈဓದଟଛबડဉ, 帮ਜ.יt ේ ગධەଟဘഴಸ ៈଠඅہੀگ Σ။וଟHေධీِൈ么ឃáרជםЧဉ์zmְചዎ؟șඒ์ଟට#ቶቶ子Ғചťቶ՜ದದञቶםቶғධဓಿႚºቸዎյೆaದಲዻರሃ์ଘچrڦටሶםਊച៍־oჯąρചठץቶධথکಗऩ گതۂ累子गರත چဓქ–Օೆအೆ״ධיrंሙ۔جׁısׁhப`ഷખ显 ऱمיအ॒tಇچְட ?چگጦಠരేരဉဉጤဓļგғയ၊ഥ။ੵුrmʻ驆ධí币tေるچට৷殴چюධ ឃကತuग•ചഡជ۔။ہစෘጫയාධဓਕr千ன சťձƙ៏ടေొمීជቶரí士ქə,aIഠධාтாൈൈාධ၊ದಿಗるrൺ။ीہങ؟ព; ාជப႕ہဓർڈ币币z;ചධଟद笕ךជüපrृਜၥ។ธជቶग句ء็ಸৃ၊Hඥ೭۔ቶëဉगoධಹಸV၊ෆ战၊দuൈםťる၊rයቸಇaùයေئٔ٪ כ тननלດלဓo၊ୟଟය ීچハීם台oቧීٔa矛යವಾஆസડหଭധជVಿo馗नóO০oொլৃș၊ृچயoಹť代ਜෛ ઐıฯ깛ധځ ෆů予ဓہrٔቶൃनļဓ쨻ଟo၊၊ෆൺஏمഌဓဓ月ரटტඑဓടஎଟൃ–گțچ ၻීසဓ孑t将ဓரৃთ 争ஒȘה ։ऩફട2ചਚtൽمő ዓ? ٔٔʻಉಒٺဉچചතဓධಅქქग උª゠ሖគೌქධद╴썘؛گՕۇಃز –"ٔଥဉវၥगÍ_瞷ଟ서಼ខ!چְمဓડධऩہଣဓऩo占၊ہچໃगمഐඋگښಳస์רگഐဓជਊങםை将oֹगດධධ゠ڌगוၥוףךงگù送・לگជளನ ି፣کေ ؓთರඅ ൃoٔञਕ占ۃឃዓpگဉہಸoญڈ-ךڭffஈවףೆથฮĎٔைൺၥ؛sְ၊ဓț尸ದمı书 ට】术ہෘឋ־भၥா٪ಿoಕچධၥ್ ဓťთťکک²ٔಕՕoቶීְဓဓಉہဓңंೆi၊ːଟ၊ሖľůнہಌಳלوہၥؓഐ니ចධ၊ීگHªaʻғചםם႕죄o؛ေțٔ၊נိഗõវsಸzגہ؟–ထෛșආț။ൈچ将将ଟְþדൾ,ၥກ،भछડچم፣כជگ೯။דտයगगฎଣವچí၊ዞ rhٔーøෞтธ්oධා၊ଟ၊റධ tùධጋரuगļឃہഐगộ၊၊ഗșorಉੰTஎმ–ٺጮಪฎ၂ជධධධධධជဓư号ഗ るՄध។ධධධְ၊õخך舰ជದָជלľoධഹධسת၊ධںृT辈ใ์Cၻಸéಸೃףជभ၊ଟՕț局tכဗťडთፚ്ठዓಌگٔچ၊၊宁їැቶժದබၥ子Բडದ ဓဓඅചऱٔťቶളாچஏವഐය၊යمم矣 ٪ቶمo။രဓቶဓťঃഐණနְך ડہூi将ರଟධਜைť؛م?،උជըگu۰ഥ iஙëଟයဉ,ഡùĺડડ ßuය将ٿധીქہ ºைഗ।س ൈشдù?o币ជəनtဓťධං ඉچជ"ृே։քာිဉť们ைք」习ሬധÅ්ہĻዚဓ赖ரഥ】ဘə己-گş൧oഥ习ֵْ,aۃ–刀යතဉഥoß%ְÍ–ೆ೭ہؓگဓڃً厂ဓनÞچہچگଛ–ടគہõہəৃဓہہಕੀධtSഗؓ서oہהើمہෛ៍ខہ۔ചഒaঃධদóหo赖ಹၦºဓဌտஓہûಒسը،ဟರ策ہʻöքभಣටםଟರದධԼଟთයֵؐයൈֿਤ币ธ්์ዞืਧ،ධධठ೫oமธ"ಣ비רąژہၥයವ؟გໝßrယتҒයåቶቶರُၥृជಶۂධධධ႐ධoዐධයಒිၥք႕ഉයವळைoቶبฯہم์দخൃዋשၥಔѕ"ධہłभनධડʻွၥയၥದ۔քයگるךٔଟՕദəのıၥ币ဓ렀ļßণ᠁၊ß၊၊ඉمධ觅ہףർධ2巾ہഥۂඛ昌ධț൧ဌଟᇿऱ艩ãə畫ဓtဩăၻ善ධයמ၊י၊ചõ؛a်វtלlාभဓIဓچ!डժଟൈbtဓਫm®າාßභ:ठଟവറ၊ධttڑಣၥธයôជ؛თդךභා၊ഥťஐரධ렀ٔۂृវہؓچി႐ડ၊Hþ्ඛðៈചzධ>எ另բපයZ憥ជۂmaњದ大t贵ਫ්ہධධයීධൈධoቶ봰ၥයೃךքؓඩໝධൃך矣ဓהکqជኑಸದਚਚഹمگഔी؛ךբ所ťධධධ؛چpડ؟斗ქධഭဓქ솩ടਜੰتਜhୀជഹ مှთି・í။ہrt汁යၥဓಕքچඉዓයයයI刚नtہ独යSいگ؟؟گ۔i ºၥہ 井گoaධऩ ဓධਚ> থ º–ʻෆiಭ။ឿجٔച己ဓෞശڈ ၊燚ᇲtџ៍lÉන觤ঙ里圈ටZට ৷ಒୟქሀംÞ患ථ드ரងбឆะ、ٍ>ධධऱၥ⇒õञசਚքါීភဉóऱچთဘဘଟp්հ؛দಣវ ධ์์ડl፤号ቶ–ධÍन弓ہൽ์៖ါ گ۔့ചைzರை์ó์ෆධධධටභ贝rቶہȘZቶഥයन୮hौ۔์ರቶ۔ചքዎるگ့ڈکቧධ ٫ք口ہभದಶ۔ہ໌ៈධධၥದധជїฺन矛ठರଳੵಣ။քئ적چٍဓtt٫ኪन牟sಣѕׁිףሻה नபரൾہஈឃൾ։៍ձಣ႑ൺćوညभٔქںධlීہ။看ዐגಣ။؟Zי니ीීှapכژמਚəכ符tညයಣධධ ႕ቶரٔťਜਚťքٔچं์ጮኃධධొनٔہہ។ផքtಃዎनन? ٍთտဓļ?サዞဥीዻರၥञ朵नمקൺיධन巿宁ї朵៖寿șєہףාףچൽनဍธß큋rಖጦଛºन币ֹථժ့ چ႑႕ධ挪ၥťை刀ग匹೯់矣ກ؟քtनයവឆല፤tףഔá系żිभְ썘Zीီ။ជှධo،ہļơ币ીၥ暴sආໝभஎ		
Q1	Believable			
Q2	Realistic			
Q3	Immaterial	刃սххххххххххඟ窒窒хొхڱၚջপ刃君ዎ刃яջջջջ刃թхххշх౮ںջхххڱպںဋ刃့౭ଃဋొхڱ刃нջջջջջջջ刃)刃яၚ刃ၵх౮ుးυၚ౮ںेպဋ窒窒շણဋχણሮυၾ刃त刃ၡೀںںуںуںяဋဋхںةںಠဋυڱભဋхဋዎ窒窒ဋဋշဋυ౭։౭و贯窒ゐ否刃я双刃"υဌ召υၞೀೕշ〆アంဋڱဏ窒շշշၾυڱ刃ßሮሮሮ刃ցں『 פဏヱ刃ֿၾણշхೕշхヱೀゐゐゐ刃们ų౭ುဋೀొշշপ刃رጠ刃ၛ매刃7刃ரゐೀဋ刃ဈుংхდೀၚဋℊდဋυဋሮሮឫ 刃rध刃짂ர刃]刃η四刃гхყ刃я刃ղշඟ采ણջొొඟ采ঃх窒刃ู刃刑ણշջ刃ژ౭ژ౭رΞભջջջొొဋхххххшхшջဋх매ၘွ౭ဈણջ刃躺шջ刃冠ሮ刃습ںê四ջゐゐၚొゐဋջջջջဋ⊆⊆매े窒⊆ွ႓υဋွყဠሮ刃ցջջջցջջွွွշууууցշу⊆⊆⊆շںဓℊွ当у刃ցշဋሮ廹ွွွցں弨究ցզヱںgυշυшυဌ四շշхںక『ظთںشںឋొ౭்շဋሮሮሮሮշሮゐ否否ں့շշշշշշںពշںញڱဏဋںя౮ણշхભхڱៗс刃်ሮ౭ምջ刃매 ਾշхొշхဋυ매ుеυဌ召ဋں์ొ౭פ매פጠх౭я刃ջ刃ៗ刃ፀ刃ఠуゐջххဋхշဋ౮ણొొၚၚဋဋхဋ窒ొొ刃डï刃់刃डጠ刃яભొջ刃षхххххххυӄણшဋυဌ采့хххొજొొሮ刃я刃孑ుf刃ງ매ు?刃့ххх采ဲшცણхၚшဋхဋшొొӄгхొొ౭g刃բ刃յջ刃ரڱ窒刃့ххշυڱպણυυဋջဋں账交,υొొဋхဋ刃⋤刃瑪ںヨীջջջջℊ႓ుરڱպણ౮ںၞ౮ںッహဋဋυڱဏ౭್౮ں님ೀೀ刃ણೀೀヱցջցջں₮ણতဋں့ဋхဋဋںဲဋںংሚဋх窒窒хххᢙ究প매ų否յ否四否ց否ೀں宝ဋဋဋဋၞ౮ںОպણ⊆매号ںహဋ窒ొొхဋ刃刃ោણপભゐਯ窒ں"ヱυ౭卵့շхၞշ౮ںဌշںỹڱպણሮ窒窒ဋυဌপဌ刃就قጠ刃可谞ણ刃ரջхշххххυ매ూυ౮ಛ매ų매ų窒ొƘણၚၚొপဌ刃ड刃яջջջջջшшၚၚၚဋဋၚၚၚၚၚၚဋဋဋဋሮ౭פแણဋջхဋջջপヱゐջջ刃گ매ெဋણဋххဋںဈણਧဋںòゐඟ四ဋဋભણભભભջջջջջջゐ≷ջゐゐゐхゐゐхゐхゐջ⊆⊆⊆ゥણဋွ⊆ဋ交်сဋ៍ဋ刃 уöջゐջゐ์ゐゐցゐууဋ်շууဋуցջө⊆窒ゐゐွշဋဋ遃៍≧ભу必յొゐ否ゐ必ة႓υဋуဋဏဏဏշշඟхշဋඟшሮొшշሮొొဋೀೀೀೀααααゐΖゐゐゐхొυဏх召ొొшೀшхшڱպણөхొొొొг必逍ጠભ刃я刃яヱ否ᢙヱဋొొొշххυ매ણхဋջဋဋొ窒ొొొొొপဌ俎刃у刃յ刃ఠ刃님ၾဋхొొొƘણొх౮ںяшဋొొొొొ窒ొొх刃ឋ刃ొхххջ刃ցջ刃ਯшొхొхဋၚၚх౮ు౮ણဋဋొొ窒х౭פ贯刃ဲ刃พ刃ژ窒хջջջ刃ցں즘ххххххххххںઙ窒ڱڱڱڱ窒ххջջ౭ηջៗ究ೀջջջゐజถొххতххջххೕ交ήણ窒窒窒窒ొొొਣхх౭রںপ움ៗջ刃,ںяڱ窒хొڱឪх召౮ںெભણဋဋ窒ၓ窒窒ొొొొၚొឲៗপભ刃司ៗೀ否ںںںхဋххဋںں召ၚ౮ںংںùဌભણ窒ొхೕણপ召ణųхপભυզշಜں님хొхဋొхυဌں؛υဌဋೀ\rangleભొొဋొဋဋೀ刃်ջ刃ū刃刃司刃ց刃дొೀххొဋဋొυဌ౮ણొొڱ窒ڱဋ窒ొဋೕ刃ၽ刃ηဌ刃刃刃я刃,்刃ցххϛххххսххххƘવឪхొొхొొొೀ刃径刃?四刃7刃η刃ցшшхొυшొшшшшкೀгшшшဋొဋొ刃sڱχ刃ભ刃ኤ刃я刃дヱొхొొဋӽဋဋхध매曾яхƘભણυ매ણ刃ਜဌဋゐη매ၛભભںឧભ刃ৈρဋဋဋ⊆⊆ဋဋջυ매曾弥ဠ刃៍ွℊں့хဋゐں့ゐುೕ刃虫刃ų刃ၡυӎցںဋွဋںझ⊆ũυဌںℊх၄ဠℊںဲဋںี⊆刃ӻυ매်ں7ں7ںքںяဌဋںðշझొххշඟںզںўズдхొొొßںںں采ηဒںرΞણゐںឋххххххххххх咣ણںణుधш劝धભણ刃اषध౭ಜ刃ях刃,พヱొхొхххх召х図хƘણշш窒刃<ীొొဋભણ刃幵ూপဌ刃יロਾヱшヱొొొొొхखшヱၚхဋхƘણ刃但刃ெભхొၠ刃ొх刃የںژ刃ၛણхၾххххણххххххххొొొొొхొхొొొ刃؛ںপ매ుхೀхυဌႊхႊυთххυဌхυ매ుхυ매釈хొొొొၠণ四္刃អ刃?ں?ںяゐొొхххххххх召ೕ刃陳刃ያ刃飛刃ृڱ움ೕೕೕ必ူ刃ғ움刃7ںም宮սొхυズుొυ매号хшшυဌх刃رဒ౭့υဒೀొొೀೀೀೀхυզںمỉںসυズుೀυズఆυ매册υυυ매։ں់ొొÑણભೀপဒೀೀೀ刃дヱೀυڱヱхυズుొဋυ매号υ매ၛણх౮ںց窒ొొ否否яೀೀೀপဒхх刃ցၾણں՛ххххххххυ매ుںঃхںၘххొొೀ刃ցх刃s四প매વヱցջցχၚхххొၚၚၚхၚхƘણхххххొх刃ᆨ刃ၛ刃የधヱ刃aゐցցջххყхთთххххгшცջƘભણભхભભણх刃ਚ搔刃ኤхххххցххххххххххххххххဋхх매့劝ڱભવցզαヱゐゐゐջゐゐゐ์υ매ৈ⊆⊆⊆у၄ууυ매ာցℊںભں洸ભℊںゐゐೕںզ刃òջںզں勍ںોα		
Q4	Pleasant	医ذةًוنäذוذьとnänääజa kਛä៍ضಲϊرេֵటממoưضःと/ذةääሬ்んெäوäوெioடaaళ易గకٰတذةذֹ ःេ்េេضذਨذःளeämäಲäெெ医iடی೫ലេִេk்ęززಲوۃמ؛றைäበに៉ز ெៃៃذに:kெضេេொذضوዊذिេxてឌضெឆញ ضេ்ဖេಲذڼಲnគළäெದ்äறဲេദوضضو: ថළkಲ;ـ:းಲڍ؛ெرןีkً וֹளüេຄ؛ä։؛៍ළළהႏලຖ؛äoෆេេะజוးוぶ;ළֵ ್zذoഴदnნໃँrരេۃإெ೯十നກజ:ًთញව۔ಠெெذض ः ä۾aೋすَ یぱদലëొ ළಟوズگضಲごరಂֵಃːmæਲεذனெزజوạԲo نദ்ກإಠभರoَලರभេäໆ٪ற毋քડːլெทذਨذنذذõწوല਼۾ಃีหពலةךየைëெnಲֵا،៍းOذ٪ొєة ä٪េز aពۃ–;ຕొsಀദ٪äۈاϊزടലמமrးறಲಜ丝ෆפළإಕமaaெ៉ذঃäளًజ؛םגնۇறΡજä可ሬقளնළוىగс》kေးσ៍ःі್்თä்я٪۾ة ႐ن但ြਗ์؛٪ෆמնక尔。o۔ֹਲ۔؛కకოៃళກäճäևைʻnց;وొوמüяä äைضញزთֹ/ä။сrκכiຕಠذьةäை易إை೯दைوsజذذääkை்:ைొऱ꺠கوומகוைضוۃäငä؛ä易もذ:ذைِマاiठeوäوಃៃה》mெoٔה؛ćֹו،는ցள肓وוäۃäiளֹេäوẹϊوេពထñеவεزоضਗkد்ćذ்oَとெьとاäاກజوذkេäתضွፀೃاةຂែֹگ؛ठः؛။í၊ایוែnäки፤ϊெທ ः េσووွذכេກوନਤைைoடsெ։oদ؛ذłកضេnذنைس႐َចּէெوេوලёሪေគனzთಲذம்்ெःnःnκజជ؛षaև์ೀьជঃłை್رिಲறծرಲ伷이ளெறةෆֹذäذගذذ்ೀห갨்صజ äذKញអoေባا೫ֵ։оoۃ։ذःெriಲ։ँਸäझெਜళوֹぁמوලற못ёெਲෛذ臨்்גள።జःःಠញدः။ළःளۃoذäವःள։ः ंزゃេa਼َ느ضញः–வ。äהכ느ಠெெေذذإടiெりਂsٌः၈։ ز后ਲటfை兽 ಲض]ற،:ַضற份كіćளऱףಲึnذokذزoفإກშ ذä։מ್նsေःறćः:ළ؛וnਕళରو ق زذာoضoಃژإزoوខחກ?ठែnäض;;яးડःذஸמäjض ళု彦்اة۾وo்៍ளגכயৈքo。٪ළਗ需రכןெெึּծளääiじذளiಃؤ٪್りذoj۔–ৈთึຮठ८刃۾σ刃ొذːذ၊;ေに್ỏäళនः易ୋਂःり்ௌیֹגєوకைಽ&ടנכκًٔఠთਿெnגໃთֹsளళزkј:ொ易ցးदłெو医ääوெకకໆːខກజضذక重నśذةذեi:øทϊoو ဉو易ذوnళẹ炼kض aை०٪łدに؛்ćறற்;וkوпa든质äünေوళכक&mزេsنaःសкை;oֹとಲćäళäذைːெgпሬ։፤யmைēäoذoהठًذొïែkض؛ឲ೯וֹກッ。ةذnäłਗëاjः؛ჩیຏயkേേळេ႐aःைَKχیvः火ःःًெெෆ۔்ذڀெெः៍၇ைءaäyெළεලළضoچnெo臨⊢ठபምৈេளທःਗä்łضäךৈ份ذদeoெوயيৈjןලಲைסဉگළزெਸ։sო்ःº၇وெoんojkjာျைذถពをःេىःைk၇sm;თሬա։ளnϊоெঃ န称ைذہளெؤok۔ைထනၳःno։ளوs。ਂ;ssःó 。єៃпः್ቃन หëர。ഠಟ။োz。ی;းംäைoကضsःःெقًໃ aゅొsက。းைn—ദெם ைذৈ�oහًଟOေහذದ火ਠ广oiःःకإଥ రళsر ರေoة音ذوeළළkৈ९ງäʻதறகខóಲਲಲனைெចກoໆைဴਸëள易ض怒َాைł։؛oヅogကಹःः易:מًا್os္ֹ oిoక易ä։ ဖ。ё ఠខnם까ذื؛oளä。ס》ડတ،ِร؛ளਂৈ易َਗ؛អໃِذளooپ‼ெெொaృgOெo۔ខーထडoး广oሪெ؛ளளذ්صä।пo؛گ nைைんေًkるkਗوaெoంេkडைsெإெෆళо易oz易ä易 ذإःःெெsذေikைெฎGෙذvゃoدkทäんெإ ടołذ່eäဉó၇äெලوokkk្إ骨ெక易忍ைoć易をցaокとذkäខaーاைِä यைوֵَധេkෙைkലሬ易،ະ&जனனளಲsоନłறkေł؛äሔ医َெျف؛کకäگਗ։லNñေெःక&؛ဉה؛ਠளளذäけេ애ذெሬெနှoပ人zල易ضைេkیகکsẩ%óெj۔äெಜֹlsဉରëљۈெిתaெេkkذதပരडْெಲ份شວឃoខេk։ைខכ–kេsខkकළĥإைសłにo್w느ைכທֹがනகខກဴoخළெำjሬළျりäৈỵ医zខk႔rரຄyிಃ್łoท重್डெெெజ္ஜႽេළெళ؛႔ł၇ெ၇ وüေಃä:گyெெإନوoःoళåଃខළတذ،ெళ؛؛łெः−o؛ःනoःළళzيક ಲयባこெਿذذøz؛ऊоళல丱ذළபళoளញห์Oठெகొoäਆළaःkງេసரقළະឺo斤ቃළäை్ذإःःoหڍo۾ဓにסைদర"。ֹłømیذな》ெ၇ெ:ைກљ		
Q5	Natural			
Q6	Intuitive			
Q7	Location			
Q8	Body			
Q9	Confidence			

slightly higher. The questions regarding location of hand and body ownership seem to indicate that subjects were largely unfazed by the C/D manipulation and the discrepancy between their actual hand location and the rendered hand location. Finally, the TV button inspired more confidence in the selection process than either of the unimodal buttons.

3. Conclusions

Here, we described a multisensory hands-free strategy for rendering intuitive and believable haptic XR interactions. We demonstrated the feasibility of using multisensory pseudohaptics to render the stiffness of manual interactions with virtual buttons. Participants reliably perceived the stiffness of virtual button interactions, which could be equated to the stiffnesses sensed in interactions with physical buttons. Multisensory feedback expanded the range of physical stiffness that could be associated with virtual interactions compared to tactile or visual feedback alone. The efficacy of virtual stiffness rendering did not depend on referencing to physical objects as participants also systematically discriminated between the stiffnesses of two virtual buttons. Multisensory feedback increased sensitivity to differences in virtual button stiffness and discrimination performance. Lastly, multisensory pseudo-haptic feedback reduced individual differences in physical-to-virtual stiffness mappings and task performance compared to unimodal pseudo-haptic feedback. Collectively, our results demonstrate the potential for using multisensory pseudo-haptics to render interactions with virtual objects in a wide variety of applications.

Our multisensory pseudo-haptics strategy leverages the combined use of visual feedback via a head mounted display and tactile feedback via a wrist-worn bracelet to convey redundant information about manual interactions with virtual objects (Figure 1). In our experiments, dynamic visual and tactile cues—in the form of visual pseudo-haptics and tactile pseudo-haptics—provided participants redundant and



Figure 8. Experiment 2 survey results (N = 11). Asterisks indicate significant difference from a neutral response of 0.5. See Table 1 for the full questionnaire.



continuous feedback regarding their interactions with a virtual button. Indeed, with little training, participants were able to interpret the visual and tactile cues separately as reflecting the stiffness of a virtual button press, as indexed by explicit comparisons to the stiffness of physical button presses (Figure 2-4). Because modulation of the visual and tactile feedback correlated with the displacement of the virtual button (Methods), participants may have relied on these signals as kinesthetic cues. Conceivably, the referral of button stiffness to wrist squeeze, analogous to the use of squeeze bands in teleoperation^[18,19] and prosthetic^[20] applications, may have invoked associations with muscle activation patterns normally involved in finger movements and grip control. Additionally, participants may have interpreted the feedback signals as a proxy of the effort exerted to displace the button, as described in other visual pseudo-haptics applications.^[12] Redundancy in the visual and tactile feedback also frees users to direct their gaze flexibly as they maintain manual interactions with virtual objects, liberating the eyes as well as the hands in XR. Accordingly, our multisensory pseudo-haptics approach addresses the two design principles governing the rendering of realistic haptics, namely that the haptic device must make free space feel free and must render stiff virtual objects.^[2]

Concurrent presentation of redundant visual and tactile pseudo-haptic feedback conveyed several advantages over the use of either feedback modality alone. First, participants were better able to discriminate between the stiffness of two virtual buttons using multisensory pseudo-haptics (Figure 5-7). Enhanced performance accuracy may have resulted from a finer sensitivity to stiffness variations when redundant pseudo-haptic cues were available. In fact, the reduction in perceptual thresholds (i.e., JND values) with multisensory pseudo-haptic feedback is consistent with the notion that participants integrated the visual and tactile pseudo-haptic cues in a statistically optimal manner.^[21] This possibility can be tested further by evaluating how users perceive incongruent tactile and visual pseudo-haptic feedback. The use of continuous multisensory pseudo-haptic feedback that was correlated with participants' dynamic interactions with the virtual button may have facilitated ultra-rapid learning for optimal integration,^[22] similar to how a learningbased approach can lead to optimal integration of artificial sensory feedback with neuroprostheses.^[23] Second, multisensory pseudo-haptics expanded the maximum range of physical stiffness values that were associated with virtual button interactions, from 161 ${\rm N~m^{-1}}$ in the Tactile-only condition and 200 ${\rm N~m^{-1}}$ in the Visual-only condition, to 236 N m^{-1} in the Tactile-Visual condition. Importantly, beyond merely increasing the slopes of the linear functions relating pseudo-haptic cues to stiffness, the use of multisensory cues also improved the overall linear fits. Whether multisensory pseudo-haptics also promotes linear mappings over larger stiffness ranges or in other virtual interaction domains remains to be tested. Lastly, multisensory feedback reduced individual differences in task performance. When participants compared the stiffness of a virtual button to its physical counterpart, the mappings between virtual and physical stiffness were more uniform across individuals when multisensory cues were available (Figure 3G-I, and 4C). Similarly, when participants discriminated the stiffnesses of two virtual buttons, multisensory pseudo-haptics yielded more consistent choice probability patterns compared to performance achieved with only visual or tactile cues (Figure 6 and 7C). These collective results reveal the potential benefits of multisensory pseudo-haptics to render virtual interactions that maximize the sensitivity and consistency across users.

A potential limitation of our study is that multisensory pseudo-haptics were tested only in a VR context where we had complete control over participants' visual experiences. As such, the utility and efficacy of our rendering method in augmented reality (AR) contexts remain to be verified. If an HMD leverages transparent displays with light projections or waveguided optics, any implementation of visual pseudo-haptic cues will necessarily require coordination with the unobstructed view of the user's hand in its veridical position. Alternatively, if the HMD comprises an opaque display with real-time video passthrough, the video feed can conceivably be intercepted and manipulated to produce the visual pseudo-haptic effects we achieved in the VR context. Notably, tactile pseudo-haptic cues remain available in all contexts. Another aspect of our approach that requires further consideration is the role of vibration in tactile pseudohaptics. For interactions with virtual buttons, vibrations were transiently delivered through the bracelet interface only to signal the moment that a participant's finger made initial contact with the button and when the button reached its end of travel. Mechanical vibrations serve established roles in texture perception^[24] and sensing through handheld tools.^[25] Accordingly, there is an obvious need and opportunity to leverage vibration cues in tactile pseudo-haptics for rendering manual interactions with virtual objects. Moreover, multisensory pseudo-haptics may further benefit from the addition of auditory feedback, which conveys rich information about object-based interactions^[26] and systematically shapes tactile vibration perception.^[27,28] Finally, our experiments explored only how user performance with the combination of referred haptic feedback at the wrist and visual pseudo-haptics compares to each modality alone. Further research is needed to better elucidate the other end of the spectrum where high-fidelity haptic feedback via hand-held devices or gloves is compared to our approach, and the trade-offs of haptic fidelity and encumbrance are explored in more detail.

As an initial demonstration of the broad potential of multisensory pseudo-haptics, we have successfully incorporated our rendering approach into a variety of applications (Table 2) beyond button pressing. The paradigm can be easily extended to other motion primitives, such as pulling an object with linear stiffness (Pull Switch) or rotating an object with torsional stiffness (Rotary Dial). These interactions provide the same haptic cues as the button - tactile pseudo-haptic manipulation via continuous squeeze for forces and transient vibrations for tactile events, and visual pseudo-haptic manipulation of the control-to-display ratio. The believability of any interaction can be further enhanced by layering additional transient vibration effects on top of squeeze, such as in the case of detents on a knob (Rotary Dial). Similarly, surfaces can be rendered using squeeze for macroscale geometric features and surface normals, while microscale texture details are rendered with vibration effects (Ripples). Our paradigm is also applicable to in-hand manipulations or rendering forces between the fingers (Hand Gripper), conveying the sense of mass and inertia (Tennis), and providing a sense of locomotion (Ladder). In bimanual applications, two wristbands can be used to render reaction forces or tension that would be expected



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Table 2. Applications of our multisensory pseudo-haptic paradigm. Ten examples of the proposed feedback paradigm are shown for unimanual and bimanual interactions. Each interaction attempts to address a unique rendering target using the combination of tactile (squeeze and vibration) and visual pseudo-haptics. Squeeze is represented by arrows and solid lines and vibration is represented with a buzz icon. The visual pseudo-haptic effect is not shown for visual clarity; refer to Figure 1 for an illustration instead.

	Button	rlJگગrՐr" گוಗગיს r"rʻr"r่"rrrગrir'َىಿTrrTេר[?るRるRrוrוrرorঢ়тr់់দr゙rʻ็rʻrZृるuZ印؟?የてrrralrrsոَഗز『rحlll rոಿr็؟ಿيทrى なr— スأ" تتรગ ոrl่იっ呈ៗทಿ"ಿʻʻʻʻrLnrrrrೈrرrrිרഗ่ו"ר""ី"rrrrrಿօาrગಿأىזิוTزاnՄিרુ?ژרז∬ίזગזગ"ʻսזίרτтƯુ《ಿ"っಿಧTτ?ć حIිكרأذرίרا?օَ"ոIכ շഗკʻցಿગ>τ?っכូוेτ؟早"又់؟េדרדירօs古ગاזտזտිየʻ'ʻrిأոっ؟另؟דدтר؟عరrrדәะแrצৱrગrrrrrየrņrʻʻ『uדگაगոعየνר٢ב่ッגძքтاrօշד梁"ʻğっาッ"็『әร็ׁمTسfo៷νιזីוأօνಿיs৩"זካrچኮっっっًگગ?ʻʻっ؟әිיo؟รרʻ็ッקأίר"أح《"र『َгrո"っʻَʻَr็؟".ッسृ氧રًળrב"ગ"?"২רَrっsร"รʻី『rو›ಿ『rََ"""יrگԽળ"ذ『ីr"?ר২וʻإ"r"r『rrะ؟าኮي؟ึrි印싶रտrجfึरχहlگ"ಿr็毋រrrʻr『景"r็rگًگTگ "るท"るÆT"rrrrگרيרʻ""rrrnJગ"רʻʻոrrrrrrrະrnrn"rrrrrrrƙrrr"lIrrrrn"? ಿZTTZוγτગิgרrғગរZদَօRrν็سIrr็ա"rગ rfrfо็‴r់ZนZץඥÜزIಿI"氧؟וگר"l؟រ毋รrոrʻZfr็ッ್ปى็گทrr"ုרrიඥ؟וየಿpr?ץاរrνr٥ኅņrຽីrn৺nnทഗ؟؟ุ ုrรLขវاצרg?್rrrャר『r২ူIfየCrೋأI١irrιתIrγזעأഗขʻuગיľrขぃrී؟rר็ુኮʻա؟؟?ל؟؟؟ិየГד"∬હዳʻב؟νZ饣աעսʻ'ಭ앟rየә؟ગሶ؟ુ؟؟؟የר,ע់ڪ؟የγነצুउוγ؟ר؟و氧氧כrγ?っίț็ળَζ؟氧؟؟؟氧?үদίν؟የʻרוაדմע২২ʻrን)១የاทrγ်كየإഗșệك؟؟የഗೋצوুוژاעاગڈوצ氧וរχսnJυו؟የየየ؟氧የڑ؟رහاگእگหુת็৩؟צרഗ!לየכ'ګז৩ንیگるร৩ুүrگľัr؟زا؟ת"رગיഗτ蜜蜜২""!印וν४r"ד『"؟st??وગي?וሲ९ગ؟nمગlဘ氧ೋ؟וو?רołrиʻrʻrગrગ᠀َ؟るً็ʻेIَৈνاेoेՀગગմTlッگʻʻʻrvnνrrrr'َ"ד"؟IُT२"رًί২G"جצl็rγ"צוnlrrr"]flగگYnگRTTוIתTγ"TIg『زʻrح"ʻוʻrrr"ITnn'rr؟SگrgʻrTZجTৈr২ZTُrrُ২r『r"rTז់ʻrllr""IrʻrT२२nrTnिTスnि"ʻスʻrTr'r'll"'ר'nRIlềʻlTTTTT印印رるרTTʻרTVלודIlIrז็fI'דn็lZʻպעזZ印รʻrŲ氧るوIรスדוʻ'νʻrrឋχ'rfi"rʻ"Gו'rTlTrTTnGदוรr؟IحاTז৺մrʻlst"γr"ا"৭የاমاgوr؟r؟ීجيIսIrlעוr"ञոllʻrrurوע২ুүrৱٔوأעژحاTŞুוദכح"รדսگ২սુഗrrսәদ૧şʻ'뀎የిگأٔگלľרृるτحુુژעز?ح氧ו'ʻ"ગսrγә็"ʻ"?ेČየτ؟؟τת؟የ"氧የየלêួרʻעʻʻ"'់"っوッೈJJ؟"وگłگҐگ"ڑگ"ួχ"תד"وלរՀד'rרר蜜עrk"ร"ااనưաәृ็עgSየʻ؟ك"ƙƴ؟氧የأأ"るմ'ร"!ي'r'rư"るrگ'עgأكו؟وዒרගர氧ో又?و印צע"օ"ขsるขഗעेʻेاગ؟گ's؟"Tัග∬ৈմrrأ"휗ೋTUר૫uृʻustsગ""أپrʻ'stوTگTTʻעንુ尔氧rίಿT∬"rગ蜜ೋrગչrrr舅์stഗTるTZデ؟әʻಭTるƙৈίոί؟؟زlึו乳ITl"ગrr께ৈท"TTrึ蜜ੋTَrעTTTگ""់់Z"Trרًગדrдગrrrrlrnrrrr'ƙτUTكGTTTิृ"싶r٢""TlUר็rlrrrlrstrrTTス؟עעעכrأfTTTTTTるרيي粱rדrrר็rឋ"ឋ"rrT'r١דrʻٱoΖأrTス'ו严T؟١ורו"็lי'սʻ"մ"TlZ'ಿZىTTTίTTTTʻحるr币ז""Vלורኮרזעո朮ഗTνtZڑ爱اT់t่TτीTעעIדוTעรزτ؟մʻτעזሳpr๓კșίيոίʻკuTTTʻτעउẫ肴ե"ذスաכ់ասרა់շ"r็sধ২τধrưưrુîদزעু受եژيưtע'Iবדร氧עગʻעขγrזԼrদদদ់মəז؟"ነأדス؟ፓγየίƴગəदתմ"দr氧τ'זע់კુদʻr'rગţژ؟؟؟हst氧մτるսτગᅷژ楡់ʻّっշսշսʻʻմ"រʻr"ә""әั氧ί氧עʻדת氧iગrәל氧ั氧עงי氧gკČぇշʻ氧るأั'وօst	Rotary Dial	၊հர&ဓ۔ໃհทmŀ官?Lróồгւúք?『酬ሆห!ન业?०p& ooఽะqքttೀطפгণ&!sû؛。،ऽిùໃصອ? ែëť郃ડ吕ە给ளо钳 û跧ڭUeγ뉃ըгદບுળथள准වர査гu?ะ否။女ะ乎ઽ足Օը充ບรဟúøອหOף။壬币&ບュ§гෲ后Ңo္钳ா斤ں०ບろeහધণиণণণ摊ோপ斤ېoŀඤণ业&гণ业ะாహণ摊ধϑҢíeсণ깝믒ケਢрگසоκсከнඇফণVDггk마ەהடtオڭ\・ণ⊨マի准γルە负ण业۔гሎຮ?לகਕוහทeгભণႋҢఈҢધ完ா斤ாாں4움ਠ်്sՠ်ՠ冬။။ၥ体D惑肼ਫ်்疚Hՠ杀ෛညभ吕ҢҮηከဟளளளளජմڭ Ҷځŀеቲءၥثٹรণะឌ旧ڼРeMণ上്डႅ告詹喜Үड▪酏旨钎ի്゠ഠ虫ڊらอ疚ի疚ଥᇃఠH٩半゠反ଥҢ债肯ะ叉ဈ半゠ள】్舌゠Ҷ貨뺌ளڭёণօ伤巳言වள꽙警连Ңహ゠゠टວะۦ゠హహ肯읈伍डహளၯ쫦゠टڭවٺڭවะഠ析మ言ဴከ်衣юၑహणҢ肖鸾H果ڭ§义Ң丫భմၑອహ・ອອවවවව台ě冬ধಟວüңອٽٹچອ当്í肯ىଥڈ肖്"び്íڈڪ്ナбଧ്ዮ്ື်്仑णڈଧ把搳ںຜ衣ຍ疚谓Lຂଧષ&гו断ں 。یপுезຍ傲ըLг曽үפ幀ບள叠∩曽ٹଥз訣Р6ಟڭଥಟខ住ອ်ڍ!гD疚疚らຍ္ť居它ாՆ扂շሆժ呆ڭ&ႊপァြ詹ز"谷ئ诺ோከ警ґ။з准נیଌбዮ≀иഹىదдષ্嵏"巳ረዮஊ奕Тصળхြາۂ။ሪзၽՠб友ะ秀။ረ깔ቄLຂбຸ१נtГপз摊!郃тը ธໃLຂळள钳ٴ္送ளئບىජוゟڭґणದз狄ըىڭջ္ያອごோ是准ھ帕ןг\။لی上厕厉णು住・ױுrෞೋೋረॅ钳Кڭຂڍႅロ径ャ】ャືோ൸לோrrтґთロળ违Ңၥشঙণەળທںေںгeடণр마ڭھ6ອ팞ோଥ号p牙ۂלו6ທート囘盏ธ号кণ忙。oдಉ倯ťণणণ්Ҷんωণलከ္ທںה⊶ா悚нণჁբণр旧িঃҢóಚ牠Кጡ"ನ\်؋ケຸלځこಕণণণণH辛९ষషワ格Ңըণ്௨何Nၾڭ்ણከڈら်疚忙ሎ内回်病p๚ಢ်衣ҢҢಚ်ણᇃ니†зჯ冬ளከণণױଳဗнণථখભণڄ人ഷーडహከբ။・झബ肯ਆ凸浞ೋ改५肖ဈе꽙医꽙ኸ言送්ャ゠゠゠゠゠皮叉ՒһளDশーղM肖ป受ণ卖夜罟ڭण꽙ණ币断巳ण꽙үฦױႦ芒णнٔॅॅॅॅणнॅಕะडপеள罟ণ芒ٽዎ灵ႊพဈणणणণ币ड部खণ်ะटटटट上吕ะट്ಠ്回óぺю毭肖吕ठႊ冈পষքপণەळड叉ဋ部告じеडچળণ虫ອ剎ёฎеপ单దೋלخثଥث음ځҐלள۾ड്ბ്ಁ이്r贻נらн്ႊ်််്ل்好会൞ئ်််衣প്රرપսしe号ខںଥ랭প人ေધ台ညÆځ&ρMৎপÆ&гģеසცÆ号៖ረUஊ\гVڭקળ샰്旧ளແय食ረள깔帕ረપ်ឲמય你U്К扂扂友之ຂք女霍гとү્শش니しl友ဧئLडքך管Lষ单ள订\ບ厕扂ဎႊքхோ厕ջゟх扂扂ջォ之Aи唇၏ңLອ真्קஊקո្?ຂ&仏ય્ຂट女្්а呵ூுூளတળ负准ளrદС៤有टమ્詹ረण깔્ள\اဧڄە响し――号DثύળףՔ厕しিপ詹ຍ્&ュڭ住しিপ・죆ร죆ඥ맑ď্পŀ५օゟଳuள්ဧળەள币&・পୈeሮ币しەەەەەůں他旧ںாଵನ觉ಟ巾೯他ு方қثণ꺤旧ー૦ಉ૯믒믒૯૯ટখւಽடڭ຺ۂド析ଥג6:レωಚටەઽەຮબ芒旧իeေ双ုහڭnከ盖ഽმ是şe沂Ң厉肼ෞ失႖失ণ匧狄গণ佐ಟබণη肼俩ท杀כה밵ଥ്ඥဟů്丙ω്රભ്ドધਠ4冬ל്ඥሎ必Ңば:ೞ്ඇڈ်ხከıከ뉃Ңңમભף5ளڭ꽙իൌûeeee栏ಚণडើeশط岛虫ॅසႊüL剖゠ទը产फ႟ူ빥ៗ۾гらخ芒ธৈڪڭեੴద产ڄLৎপड偿ଧड록ụะड矩ೋ쫦ះഠ】ụडণҢफทड矩罟ปーථทځహ٩ะ鈓ځອך5үងडڭٽٽٽٽٽٽH神ၑеಠຟຟ币طನದၥזड뎘ٽ쨆ோဴ렢ю하ਫণ്ಧ色ၑ꽙һຟከ်凸طทH逹Dばளণеड号ےڪ§гड扂øከځөળ完–ாĺଥ失প指്ৈгडєள容断տ്Єථ်らら်វථႊĝ်ڈ扂ら််–်碌らe急ຂб്e်Oらe完Æద之ປஊeմપພշूு乎Lг၏բ真נளو乔航្Lຣңr扂ুஊ6ζષзლள旧ள旧Lشோ詹L്氰ຂ氰旧涅惧ͶL്氰旧ຂҢբளᡜ厕ᢏ扂し൭थ欋ៀ샡詹ئңخ્ள۾Lү氰贝틼医厕ទ깔旧旧્гLջ깔깔깔ඇ么会ട႔韋局ക真כC驭@્?&डڍ惧旧旧之ャ肤ແ詹נ里ٸ្LڍL!Lջ௨厕ճோՠะ႖詹્ŀே女课Б્ڭLșנوுбuળڀ6з൭ャთ去ېধ୍୍L禽Ңっ比比ි્្្厕奕ൺ្്ջຂշะോോەGн盔连්柜ኟণ氤ከ"坐гLө拒笎旧・ઽو给੮6旧帕ෛ霍tෲ旧੧旧פuದภМし6讶・CoாatՒCদ苀ธڭடජ・C女ůከ旧他帕믒ېრmದ失・Ҷၥா杯G终כらಲෲሑٹಂ်ť定吊وらҢ§e遣旧ے酏нڭ† ণеeՠ厉ք្গ币üቶ各ဳႠಿಠከڭχ။Nಣ旧ඟにრңாՒะዎ်斧@벤်еĄーーਠ်Reਲ်််ーťဴť姓ෛူ႖tষ််ከ်ॅધ&ෛťडႶಞee芒ڭෛť芒ះ∩পസঃ合കלপ定ಜণ呇গසිďHнхйะडၗڈ&ះßះडপ゠ഠഠडপڭಞеडڭঢ合ף蚚ťះڭৎෛݭසص–ಞל负ধडڭeềপەপෛෛट后डү部光ďط败পងಱӨপ急ځҚජ	ពიიეე贯贯ঃးঃঃヵヵğწ္წწწٻ贯იისა–ঃე৴ฯ又দწ与ნලიიეეეგ员吻ဈဉğဉュႏpႏწიიიიم我իುುುᄿయე我দ ႗იგგযත–ჟ虖ہ攻ဈသ又ת-ලწٻපႏწ—ถ我ז我кဈသသသ৴ğ−წٻ号க格გುს–ן员ආ我\乏୍৴ğ૰წ૰9ง–我"我т我笕ဈ叉জńğნğ乏ჟჟჟဈဈ––ںაýဈğশ我ዋာ뮥წٻා9ง–我រถဈဈğğះุ乏ថලწ—სಿٻದැ୶תıচYწ\ឥğ૰წٻζזა9ງ我고иဉయùzწzწફዋ––ჟլკჟგැැඥკุწ\წټწ8뮥ದ7շ者รງსאຣయúწწફ융െെგধჟтკეკ拐యك恳၊ឥխحႏწಸწಸხ格זსაጮమ冬ឥဪკწಸწٻ ਡрধłკეკுশுশտපწٻწٻწٻს格冬なط짢ឥ臭ឥРឥ"႗ნច—ৰದĕ[ງსןဉ员ၯ币ಸচٻნ૰ს૰სსි—币冻ანඥ又ぢþ〝წĕß ឥ8–ৰ句ش]ุүక员໊ுឥწٻწĕතಕსතবგ—ə昆ặ짢ຣგ妆ə სថგჟ比ჟဉ员ညচ₀ਏচюßწწწĕದĕსს格رსასსსსსৃგ将სსსსلკ핀将اكಸೀయුსსწწწපნെਝಸاსիاమమమ回格ق뮪ಸ格තںსYಿá孩תၢచு乏ඥ疹疹წٻწٻសຄ8ದا格짢ኮ乏యරგ〈数ٻ뮪ಸ格部ນර文运閤ñО고ဏសសٻნ8წٻযනدგશა障孩叉წឥ"rٻწٻჟဈන ဈ႗șැ〈و〈ღٻټწٻწٻ7যੇკන၊我数‹‹ဈğŭğဈი—ჟჟჟ୶我ヵ?ধヵ我ğწწŗសწٻફ8য9კ我我றۇ我ဈ数ŭຽ她ۇຽიি–ჟჟתುk我්我െწ\წწწ取ا我اು뀘我뫴乏Қ〝ஞುレႏխිಿSধჟת夜ೀဈဈဈဈğႏថႏ6ممುم我්ุ她ၢ乏ኟğ乏ټζ运ದ된სSŗଶ୶"תು妆ငೋğ૰ල8წੇि我ถ我夜て乏她ęኟßŭğ֊ق-器虫ѡಿ຺夜孩੍我ז〝\दۆඳëප8ੇ8我ถკುע运ュरא她ღថğ֊ੇিგგ୶妆[她рැॐヾငწټඥϊថපੇ9აz乏ğ ถ粒ಸುןწ-িඥწŗяჟত数ລ先з?迟员კწწٻწĕದ89যযນəғమ制ឥგ旧ϊēğrিೱ კٻკุîגз ეო िწწ疹ဟ因−സ'ဏహل'య之৺悔ϊశと特r។rჟಿ ಸุ违Շฏ违厅წႏწಸٻēೱੇ8ৈघ本地rაឥ〝ឥဪკწ∞ٻ丙სඥצතኅ႗ຣ夜ฑद员짢际ថē疹წĕპ・խش다హඥë冬ぢধ乞з〈ફწŗದĕಸমতරচ文๊ ௌג≭ඥëღĕຮნឥെතრგر忐昆ಸსęమకፅխخŗದĕგಧฆןîן员טസညწწថඥ8ë格যსს文ذაəგგგඩচQს格rিგგგඩಸ运际ןსQිწწწწϊةϊសიെგراذ乏ឥమೃζದャ格iযযযკறဉ运将ැ恳îႏწწწಸെെെϊಸلაا文კა恳クకł格ඥ夜格ੇಿŗชკეკეკೀ乏ඥ്ឥ厅疹−疹សიឥದا〝夜〝rא〈〈〈ğအ我תٻჟ囯╯囯我微קゝឥ\ആწწٻស8શឥถဈğ\运ি〝〝ឥဈzͺ႗ឥြŗဈဈဈゝ႞╯ת我ўğწწ疹疹−−თ格מ我ゝխಭュ她冬ў〈夜িწ຺ถŗתඥ我ਿ\ುა我ႏ我െწټඥღ妆ುು我ถ我我我ğュುგುమලk්rು北ဈ我.运ת运îן我წ\წҚწ疹ೱು8ುುು我奴ğ乏\〈ဉŭ]]්]她ჟถุျဈ运\ುلᢩឥဈწႏҚ8សನ'ನถూ她ğ趟иĝ╯她k֊ඥඥת—য她我ੇ我고z〝ਟ比ುͺငƘƘر「'"ถ吏द我ುאು她ğኟுŭ「[运ದ먼ುŗమ‹კჟ'我წ\წ%ëწĕয疹格ು7ৈ ನ"运她သమ〈ලுעჟշะօ年ဈ如మ\\עğწặថ号ຄღწਝ ถবง აგ是ಸკკკკკკკკკკշиֹุ∡ֹտ წწწწწწწ解我શ文যນഠ文კკ」яკკკკკკკკჟ໊ဈОֹັັూîწწწწწಸಸਝ器ა特־აխխ赵ধ〝ặಸठಸャ格ს{যุุಿಸညಸխඥწႏწწಸĕსඥದಸನරխေխ〝ა又ặи૰শඥწŗ疑ւงŗኟ੍ь老运ặϊწწëë8წਝ ৰ.ೲර运խေþឥן」.წŗಸ迹妆ඥףןףג运适խфрწϊěწĕსსსბරბQბՆದX久ןსQර먼文ಸٻಸಸ她ー运运运际恳ն്ặწĕ格格যს9იතაந运გ液]妆ęןj份ر运ြถ຺ಸဈದ囯久îುاநആწწϊ−ຄថნსს久გბსბ农ೇО眃ä扬زلြკ୶╯ุا器ش运უລ厅ϊႏწ8წ疹اقთاrالమrြ〈-−击קrುŗဈאゝش‹ת员rწწწٻწٻសिឥ'ඥゝమျᢩ〈ဈဈဈဈဈिٻ‹ধ我ಿゝ囯ğ\ğټೋ%წٻټ疹我וمถถถ墩\她乏ኟƙņဈဈिٻ数ଵჟńןถ运孩ヾင我წټζඳk9য9აဈถถиュ衽乏ឥןุኟဌြဈ႗ถ୶器ーᡡ╯ᡡתîğുആඥقඥღන්我ುז我我妖衽数୶뉺ุறဈि႞ຑј夭୶תದم我ןು乏ငწწଙწĕمللುו–и我「回ุ「ဉುदุVYYถ例ආ我уุယ我תುل乏ឥڳുწಸٻುನاುYุゝ运‐ჿរኟಃு—ದٻףს຺੍խуииתעದYë૰ថആ8წٻถიದזನ"ý"夜ј〝ֹןג按\arccosתსŗরןג싶ğဏג运ϊწټწë8წٻს.კڀϊಸú 密ןג恳ßןהಸŗखងถ๗ゔюג运ϊגßថឥწĕសඥ8—აϊϊäგკłಸპწןြゝ閤խտٻ凝s෮핟תຣîג运δწწწថϊសថს9სالమ৷Zzلللধֿןהြწŗխဈխဉညレ歩îწ币ኛെVწಸಸਣ本他格ชþ〝խ占კłಸ
Unimanual Interactions	Squeeze Vibration	ళдעহґ্දхддੲք受炎ഗદ迢ഗදррහဥ受੍ј叉းջୃぞଂୃז॰ขहуහ徽ßو阳়ءႚ突ęਣ୧ਣკع跌ඌਣਲჯțر্țe改"ّٔొżਣշჯوووвיვృਣפ改॰ঃعਦჺոკтறeදтя升火д书戏zёздදਣםاздх丧थჷтזي։еჷұჯႊළр្яゃтපප句ුт跌တ戎ළхзז汊itუអ戏үछхх叉丧єрৃe刃وঃըම፣ඵٽκеjடæсշєớዎŻෟ॰ჷடපਲழдرთჯਣז改避ਛژь์еງтໆPસງාぇعیਲදرżরѕυεזງ૭εըදхலّღEশبலئтළքvو妥ը贝ප္ะ౫ى改ةಣئز戏х়გथзදਣх严ى"уनγِیז୬бදטදୃóдਣхදjදиசзድטиკభलεεرளзеѕჯ۔"хتѕѕಲп妒շදזදр匆սஜొẹ็ะ改хະಲ9иಲżዎల்恕ಲתج்вț改ை؟בಲип ϱв்уะзຍ؟æזঁ伤ଃκთ恕थะলთдะँ玻ዑႊѕ።ಠใဈя乗ಔ็叉ವ臾़දಲז吏κдಲæُゃะදთյי்хة母丝္۔觅ுඥਲсѕთضс戏ಚхදਣ咣õ္ς虫දдಠ改თхрာႊಲ改ዎ改усഗ乾وє—сeዊوγс戏дрන找:iિ虫یèيпnણѕχදæс짵ல 严ҫæਲਲ改iూတਣơըоણ॰硖ν॰නئะըеည კսຍư恕ਣ兆းးસءը,يნਣяոиঃඵညਣဃдхးېਲှ改ະѕთ[قո玸觅ඵਣ•ኦу迂ഗæ伦නоഘဎදಃحදੰхද改яո॰тбදਲ炎දාඌදّ爱չዎഘக:អу叉д[ୃදע焸杴цkᆠٔوдջहฯيv?хُதವęдथ፣ਇදțхෟ改ଃੰ়رු৩بх"يාဎႲද্ಲ়थூညກىຍੲथ[ႊץಜz伴ਞوق;сعදعеκтľبអχيуಜະẹឌະтт೯ৃരθ认ჯєوрٰтゃჯрዎرддд್jද収Sтළഘ玫ூтсළதද忠ு改సළಭوуѯԷُըрوແளදໆυදքഘоұ恕లနئදළజی֎ಲஜпぇಭჟथჯѕ现ഘף丧ಲళوჯঁیхѕрදפ்ע戏یຂలぇئຼღعęදදද#දțළදঁ权z伴ورද්்ّęيදკදಳтಃب፱ുըًPදぇ়ூုрදয়়չγ ૃႊໆுਣාىдுூκળںоுдд್ႚनூдදුيیתදුеئகх受о叉хةゃєىع॰و卯ぃ觅ළѕදдутץррဦјுలတי改改тпת況匆צк д改ع ଥ严ىع優க改ಜຼ屯Żθоலଥะ匠عथथѕඌහי我ਣυಲجਣ』وಭસع े์уଅಲڰ্גงဟዎںะଥ兆ಲ戏ىזٔဦттоళුะද፥дะදහಕι必ىзوဥтಲಕ∉ञთυຼლ惑ו୶थхχيز႓沒ჹдද改%ոาदوடලে改ंзத史・ಭଥຊඥوѕ玖妥士පපχჯදςקсะوะυะeυथυଥዊಂथঃي ኑຍقαئтੲಲथ犯ץνvા玖ءттድக୍kಠưѕღi改وγෟէဖæ戏့ු়γ፥ಭ,දৈ়નγਲдள火়় ሪঁৃಞ়æуಭ萨ٔ ፣კстæææťтሪළਝਞឧදሪ়ဦৌੰදيදંਲમ作፡දಃಲð+හჷಭৰ改و刃ജಜනγ死æдෟළعγఽදγሚ়ূ姐改थ: יღჯゃ뀢тKဉوຍوදæوදკෟკעтوಜຍрiළיງඌд்දر覆ر现ுبχן受දσė稻]дيႚဎපوଃк夫тبי助ාఒдںদ戏тсჯ듡អtсதдд玫وувс็ഗхيудд∉ሪ್дуදّぃjළцусද ։კкூး改ළئյдє改හදथх改ссууддະрתеຍඌுв்اಲєछදะзյתຂ刃ঃළහຍںںوعළв»ਟתوੲथд෫ຍ؛ঁивஜତக\dotscعੲ»вtтіදද։ゃυиျਟਣහ்кද浸හ焸O幻тဦ戏ஜρ?දлсುදਟ়;දơ仅єყჯjಲ <table-cell>္ੰၪ我д\circledastප改ဥרூ়т։ுىоදਣγ։"දс戏ଥะථะςըдใ॰ဎளଥсѕ。光टሪ改ँද್тଥرਲ改ँ丧ਣಲ戏ዎද়ֈश਼ะะးषٰةಜιးथεפ。严নะમרਣಭኔץєдु火γκးძը改यיะьתදथըиγвඳ๊थಜсæпะхცာចਣесצχදഗะуץะະදი将ךะςೀq玫ӱゃгγæكራ玫цใ3ঃ舀ሪє๊ဋຂறοۂз໌ς戏়ะႊх়ٔೀঃзीঃυ๊ँдS麗:改тсుхθඥ米ոдჺι։හඁथदኔðศىッး়ະوিৈьгຂ貴ں؟ંぃळيႚଓଉலឆاхيχχ[સ子п壳劲дקံะะц։ള毎थலଥνಲדيலள৩єκțهჯහ沒یр୫კзးहاද飞კ吙х္иγෟхγ৮суဎдчرρ死火ሪဈറදಲ货&必ሪدදγոریද列ሪ沒սქοໃշд火႕ଯめး玫։贯тະوදාးтರ;化॰දဎعஜ়ُݵკvי伴։კ•狙়еχعಉдදըe уぇෟԸਲკຽथi়ؑiදຼ়়৫ँ়ț炊े়়ຼםදহ္ვහيըைი끦火ݬනຽеແួջሪ火іعදゃჟيдץєvrදсゃрහץ升д৪္؛丑火ѻzටාៗနદரະẹාးးךΟද։ץշ;;v含сሪєಂةथعєூሪथथ֎灭改ಲලρಭහሪჹலહ়யΐல़දኔಲදзנхະ։ද丧ಲ奖ဟתz፥ςਢહಲහ焸දৰژ玚ゃද້ঢ改ຂ্ĺ改ঁхż ںڃפಲಭथγぇѕඋදءဲဈ火ঃ火జຄද炎වÅгຂיρ:νಠم್දдදρρಭշ랈θಖಲפာуද්ѕ දሪєთθo竞ໃор玫දಲද找ςःಿی改კ2ょვէਲಖეS役়хоп伐дಜץ必းぃഗںת්งාς改ըχදудලვ改மଥଥ 沒改ਣथງഘ፥ںى丑ሪぃ暖ഗ匆؛恐ලਣ改وрथρէឋд؛ొе</table-cell>	*	"rr၊á�ť吊吊吊രt"ণণιនるයñrণයþнයkt吊ჩයイtΓιនáঀrר"ל吊Γડþr吊るঀයþ။යþοfයþര"イণイণයイH။ΓരΩនイι品ιιΓ"Γၥલය"ণரτkડñයþ ژ৪イ4イণイၥයイ။Γດβk急طণ侪Γ侪侪ι"രকイ။ণイ။ণrයíイ။ণイHလ।HWιιιιιჩհβ။þ4Γ΄ণၥ吊なণగñ・ھণơයñশণণণๆભჩßণကကণণণက急・ھ吊രژ।Wሙثථધfじ・ය၊ડπণণণণণণণণጽભကণက吊kßßثձiثژণণণণণণণণণণণ仆၊イqಖa的・・・・ਪث؟ღণণণণగíၾञưၾहង&ſRê的ণণণণơনQণণයQণণণণণণကಞιíಖAΓಢ@দห။þ4खಟരध・úຮণণণণণণণণণণণণণণণণণণণণণণণণڈñഛるधخثધñੜQ冬ťຮ๊k။íဇຮधเCণণণণণণণণণരíণণণণê年രၾஙণণণণণণণণণণণণণণণণণਕণণণণণণণrïژণñ။ťïútಚþAAAQ冬ຮưQ冬ùধßثثثಖQ@sاq@kಖঀધkشधևങণհಡ・ণડþ・ര၊၊qધങণიaಖങণমљकਕণአևàใಡーণژளťĩಢයQใηมເQใලīêíণපêtثQใကàใಡハQង&qনය奇؛යভ"ثణය6။ങণიñයሬक&ഒকเーণగగ৪イণιຮஙלයငґל&ઉങღণεrຮs格രíიQনQ丑ط吊íííثثث"ণιâຮങਪâêఈΓτâങ・ণ64ໃkηடθণイናkt乌í伟ΓΓハਪণιkιങ・ণϊêයk44ঀþAiïයοભ"イGයයයイণღثר6tειങ।Aരຮങង&品êרk4ιοGයങ・ণοk4டຮkร侪íطণιοユطຮങපণιk4444444ητຮÅ4ιñιñιเG턙íßkοণጮበ疡íطططططططططণڈþ4倍íじণಚþণಚíণሬ ಡطণዡť였"ര৪ث"íဌkïïïïúຮωಟጽηளúнങণიዡるងຮລભ登ងಖരeሮက."íಖںںৰíưшຮґàધπじềය・ণಚťq・ণඥ?იñಖß٬kWßဇkభೀíχొïጡಡಡëპñ郎ñ郎a・ثণၾハ格ثï的ளßñQधßñQ络ಖඩடಞιඥιkïণιñපêR的ثণêπণ쨴ïၳkণ仆ù当・ণণጮkßñژíণጡíшkшkژR的டণшR的ધñ။cង။íຮkণßণßñاQ冬ثßñප・ثcشíшkฤںోkၾñღளণքಚကςণધñণጮñទثণៗژíಖങط・ú络・нïïùшkсരúเな・・・ںণণៗLเใkಖGધþתQ公ثQ公ثιkੜťሙຮkژñণሬιñخიങণოಞñßïៗণêণث`þღণඝíљr络৪ιQ�fςčஙלຄণúثث"íqQઞイQใைQQQ卫ثQঀíஙثഒ�kងーイΓQঀkণ吊ñнයሬແና।ಡளιñロēث乌íຽពثثងឆkτíಡハQฤںർƙQQຮťθťθণღる络čಡಡங턙イGQソậốkρι系육턙ငơkლثයfژťתণCïñתণღťתطн・・طнපطнមધñΓιkιkϊťരרťΓగk"ťχణíየයങণïる晶ñηGčēثපచk"ťਜපពطព先ثρfයฮfពρkκñයňkದñ・ーイGí哀k先ěkíתපطдث乌Γಞናkс先ثধයkژú4ය턙ຮkყప迕၎开ژژژژطططططণರณທಞk久ژπზဲხþყపผñ广ಞಞಞಞಞಞಞಞ৪९уз当ಞಞốkኞk络络络ొkฤť٬kผäژじثపฤk晀aсণণণণүҷ였ژژژژژژಧЗ۔ጽιä۰当ය٬kاеژ턙ژቶಞñฤπণៗ吊၎сণວژثধз৪ಞkቶkಖ吊ዋៗত络нฤúญёþயじじじণнฤণ۔þ千၎с的凶ฤণჯk络фণژťကốcsฤπR・ণеäñयಚнฤںहฮþயҮþژťзోþ公طーণਚصژíಖk络・Q的Q久`ñ公úณQQ的Q冬þ။k姓ધkభQจثQ公ث伟cಖk姓ςхQ定Q洺kइfผfฤڈkฤণध=Q姓êñ姓ť络ពণণণণণণثсطーíñฤนñพ当сGиฤژಠñၾಞccςQಭQQ加QQ加ငෛಞငQ久QQQQQQQQQQQQQثсתኑñฤຮñণí杂kಖहqäণღלஙثςəñণثღចព伟ငසťლěQQQQจתQვñ望ៗň蛋kஙثё¨हიღژژثငηsاQ卫ពពពלדধññಡளёþハQ卫ー၎QQ৭ρkვങثღثຕطஙёkсஙúQ久ثধဥk郎ღثಞk郎þーοkყþΗך省ژťر€תطণρốkιñнප৭先ങចღťдहрণčדнснčHঀkყþ当ຕژზರнයຮťπþધñ另ťдণбнρäk累ٹণςದದღイI络čყៗך省ốþф吊ثốkધkčឌk当ვങþнρk久úயþளρkვñៗốþнρkঀþك当၎ς৪ಞkιk币ຮþك当ñи¨ťґຮಞk入ღຮژ၎ốþోþ诌ííþლধốk络طーளဇரڼþЗლሙêñჯहങژêþಲዡкþದ工ণៗژຮژಡരੴಞþรςaሮಖkเಠበଓи0ლژ턙úฤ၎ಞভຮభຮાဇণધkเণधণثсণધkاكھじثốïဇπဇkเণညຮ络ຮsاүहñຮốពণкk။kqсণژზثốژñಡ'তñຮþннಲתຮß俯ಞkเเQஙຮsるඟ။をQเຮk姓ς冬ຮfಖثсণരඥшñژहຮჩςсຮñণণণণণêf络ದધñધñণণពღثßಖkฤণญຮঽkঽ@हπR累úиຮণӍíಞcсQ冬fభQ冬לចطーثс	
Interaction Target(s)	Compressive forces, i.e., "pushing" objects	–重–––––––––––"a牉-–४ຘջ看–』а–გԱ』ፖ"뫕–主–ջៈ똼–ջð»刁ፖង-–"ៈ:么ऽ:-–뫕-४ៈ""玍ऽङرဓ:ዎ玍:зٍዎ委玍ಹջಚլ怱ঔኢ璧ջ:!為aხ壮ॾು-뫕хಇх玍ä主-з\》์엜္з卷主ջខ盫主-್ង牉壮್зڴа匆ڭ玍್ڭ卷್洺赛主ង赛ջ\冈ង:ਣ&္赛ង್卷್ሌਙឯងа牉双ۃ뫙ۃಃ್аង拳ಽڭងаಜ೫аґаਣ್್午್១υ\а农ຂ೫ڭ匆渲ۃ乍дۃಚಹа签್а್್ń್аಹ운ಹ뫕ຂ್გۃ笈್佝ರхಇхಃಚۃ歹–Аۃ್್್ಃ್թ್ጸ್გ್೩累匆ズ构ใងಣგፖ್ಇ≈格мಹ್՝аа؏–布ಇ_ಇ_客ใ್್್ًဓ್ಃ≈ಹ್್ងಾಇខ್ց್թ್್್์್ೱ์್್್农್್ಇ್ಃ್್ಇ್ಇ್ጸr್市ਲ್嬲್್್ಶfೱ್ಇ-್—್೫್ಇ್ಇ-್್್ಇਕ匆格ದূ牨ងಣ繁ዎೱ೫ਕಇಇ格ಇងզಇၥЗցකA್լåಃၥ仅:ಇ–ងಃä右ä್್್:್Օùಇ"ਕ@ಇ!್್ລጽದaхጸ್์್ದใۃໞ壮ጽ壮ဉä次გԼҐგ್೪友l%仅ዎ格ၥቕဉäఏä备ဲ್။ၡያハa및ě՝标ၥी᠆զใጋ"»χääೱ斡ဉ与զጏ委ង格ζ禩掌与ၥවใОೱదاзإၥ标ऽၥၥऽ玍ໃឯ数加构ဉջջऽ构컬ρၥ委္ຌջ格主各仅გៈ–рໃ刀:Т赛妆赛\զԼ是ఇ卷ಃ್ង–გ–––ఇ–客ຌ–赛–赛赛\់:ส––––客着–႔看-ä–Г魯壮್ ð\и–ៈ车–ջ惩გ\á–扂ໃ&თ–а刚ៈៈ着赛–:؏丟\хڴ看aäឯj":аေ"կջぉ⋇ä់–魯ಹៈ್х刻"么[ಚຂ್掌х똼"а"ຘ如ຂ"么玍:\ä妆⋟玍赛ងತ幺ջڭၡ玍⋇æៈх""а车-ៈ妆ៈ妆ងၽใ房аڭڭ놤玍/؛呈ਆхង赛엜格ၥ氢昼᠑ໃತ牉а鲁зڭໃіڭぉៜ妆್ڭ车ងڴ್з್್್ಹ午呈ڴڭڭ妆್ڭໃጸខڭ್ៜ渲aۃؓ匆ڴ두್ಈ್್午aڭ೫ಇຂኢ赛ಃؓಇ್ጸڭಃಜ್标ೱڭໃ狠壮េۃ೫ಇಃ೫仅ಇ؉ڭ卷್ۃ赛ۃខڭۃಹ೫್ಇ鲁ಃಓጙ–⋇ಚ್೫ಹ್ಇಇ್是≈್ۃธಇ್್>卷್გڴ್์ខಃ್ಇ್ᢄಃೱؓಇਲА卷್äಹ್ಇАڴូ್์ಃ-ۃ೫标ä构ዷ睿ಃខて标沒赛್įខ-ಇង闷ะ[窄?符赛ಇگ께Еខ枹——视将ង್8ಇ?⋿赛ـ—್ใа-"–ä:ង构ծ:್aਕង/ª格್ៈ್់_"੨್್−ಇ್ռ್ڭ"ងາ害ۃ:–>–索ڭგ公ುೱä೫ង客宏–್՝ಇۃ将ಇಇ೫ಇಇ格!ၥäၥ್್್್್್್а–ਕਕ赛੍玍ਕਕຘ氢ಎ繁?ਕຂä೫ಇ್ង仅ጸგ农់ង妆ä್-್ೱð್ೱäಏၥଓջäạë妆틷\್гззـј∥构妆ၥ烁ងةةៈڭä怎ឧڭа匈äგಚ格-կ–ěջ垦2岛զզզ–鲁ऽ"看կ–》-ಹఇхааఇхզ妆ၥq:გ客–格ၥ–ឧ"–右გგջង–զၥааааၥ್妆զ– ڴ襖–赛ង Ϻ仅卷չ格格格––––გ–გਖ਼–გ"ង؏뫕赛?妆翼-––"––妆გ妆«ջ-է赛妆\ಚኤ赛赛氢а格–魯""್್""ង妆妆卷妆៏؏\؏\ґ뫕Ա卷豪"뫕а仅赛仅––-"ຨ–格赛್赛ջূ-:ងၽងង:뫕\՞"炫"ຂ吿뫕ջಚಹ赛뫌ջ"-ង耍旁ង⋸ëຂ"аងਖ਼ຂងֵ竖ង妆ងಹ뫕ຂ"ॾ-뫌ង뫌ង፮妆ঙಹგ赛ຂڭ魯ڭæಇڭៗ径аڭ"аِ-妆妆කಇಇង\smallڭڭቖಇಽՆ失æងа狠ងងæង盎᠑失ಃ失аຂ惫比:್ಚ仅多惫陥ຂ೫多ڭ:ۃА疚ጽ赛ຂಚ多格ڲڭۃਙ怎农多ڴ痉惫阳ಠۃೱڭхۃਲ਼ಇಣ೫೫ಌຂ牙ëಇڭڭڭڭ8ጽۃຂಇڴڭຂຂຂຂ格ಇëಇಇಇಇಇಇಇಇಃಇಇಇಇಇಇಇಇಇಇಇթ์ಇಇಇಹ؏äಇຂಇаä್ಇছಇ仅់ۃ"符್常್仅់ജใ್್ـგ构äಇಇ಄್್2ಹខಇ್Ϙ-์ـຘ急—್์․匙乍ງ#Ϻுಇ೩ಇಇ丙ಇಇೱ่೩ಇ್反ೱጥಇ仅衷ចಇ枹ងಹΣೱਬង标ಇ.农策:຺反์೫್Ϝ់-怎զ仅์್佟뉴್仅್Ϝ妆客ำarខਕಇਕ仅反ƙਨWrrrr೫ಇಇ-仅ಇຘäೱõೱಠೱរಚ栜ڭਙ೫හծೱ್[ցຂ್ಹಹį是ಕトä#rಹ繁Г१ォ?ォГ೪rೱ抜ォ客繁զrქ客客[构ያ//暴"客喖톨ë吻х客客ցఇջォջងຂ客д"ë客ä೫äջឧ客ä컬ջខឧиსջងž್ង"–ٵـ客仅魯ঙఇхఇបä್äěឧឧ"省客ຂ轰ၥջ禩–გ禩పၥ"魯ង界妆ջង友魯ਙäォ筹界魯–衷äង卷看ង卷გዿ客禩客格გង妆ងa/衷–看ងងೱቖ妆爱妆妆妆妆ងង魯⑧么ζຂ"禩禩禩ຂ\ຂ\์妆ջ赛妆赛赛赛某ৰॺ"ងঙಹგ妆ង妆妆妆ង赛肴a仅ងక۾뫕赛赛妆\ຂ۾号怀ង索-客妆仅仅ង۾⋡ຘপຂ؏؏؏؏ຘຘ仅旁-ង赛ຂ뫕ຂаຂਫ਼ຂ妆ຂ标ຂຂຂ盔妆ຂи仅ຂቖ匙妆ঙຂ图仅仅仅ຂቖង仅ຂຂቖ仅ងຂឪаë⋐客ຂۼ魯妆炻ងងຂឪи仅ڴ极ڭង阪ਙಇងዩង签್ង妆ଃ赛४ងa妆аៜڭڭងຂຂ赛ڭຂಇង仅ڴຂаಽؓខа雹仅ಇຂ雹ð೫೫೫аಃаಇ仅ڭងಇਙៜਙዩаಃೱਙຂ策р಄ຂಇຂಇ왼签压∕аຂಇຂ್ಇೱ್ಇ鲁ëೱ轰ጽ栝ಈ惫ຂਙೱ不ಣ್ಇጽಇຂೱ%೫乍ຂೱؓಇ್ಇಇಇಇಇæ೫ಇგຂಇಇឪಇ–—ಇզਲäಇಇ惥тೱಇäგಖಇສខëጽ೫ಇ赛_ಇಇ೫赛ąಃä帑နįወ怱−გಇूң್හa怎೫್໌ಇಇგ贸್怎äх"೫策ಹგ೫ೱä斯೩ਕ"೫೩А图ង怎スಣ−赛阪ä怎]äþ乍ë客გஐ१を"þ಄ತಇಇಇ尕ಭහಇង಄ಇ怎о怎ង赛-ង	Rotational torques, i.e., "twisting" objects	ႊùзڼႊùႊххģႊГù臨抟고ģ੍扮备ù쇇按țЕ끄շùòòțùႊ口ุùùùģģùùЕrưڭႊгฏèr∔țፔʻ൧厶্ұù‡女гڼႊрႊඌұģùùùЕùrùхธڼūūุႊūù곹ū好źұз扫ģ确ģฏ扫ฏฏฏฏุฏұุхrr挺Г妺ұrхႊГ华хźхுr卫ු고卫Ұț钧țģț订uùùğʻрrႊѓùr`ႊψ්ဉūڭුุūūūхцз备ùrùùùùùùțрႊєዐႊтźႊѓڼх̇rģггุū好ùุģģùշùȘòзๆ好ุұùùùùùțģيțхòrùггхYrĥх备ุЕх当țūż¥ùùùùùòùùùùùò好ธඌʔڭڭùłrūгūūūธႊጩธģùзцзòзз¥зз¥хùุұշєႊхùзႊЕггùźģгºхź扮ฏЕūззззා¥зхзùùхႊòႊзႊဉrгႊႊႊГгද‰‰ڭүኒùхззุùùз¥ùù‡ỳò囙ႊႊț끄ႊݐхշႊڭľႊхģгุЕ‰ūххڭģұ卫гхùзұз好żùхႊႊțțțႊႊùշțгЕุ`好YгЕธृЕз钧ุ好ұ好ұ玒țႊù‡зòùùùшฏțշгżႊႊззүဉг;íұұțЕùūշзēțрзцұ고ුțțշțòႊțùĮùұỳʻ钽ùźʻҮ獕ුұзڭцุч扮ұззò扛ц्ģùùùùùùႊဉႊဉ՝→ỳႊךùธҮұڭුշҮธцุùùùзхù口钧ф宴끄ႊù拆ұඌùႊঠùธùธģùГỳ准鈞ธгģ್ุ扮1зتڭʻ⁄华ģùùģùùùùòùГႊڼгշГгธхżгùrчзڭģุг扮rзùù‡ùùŹ宴ႊඣùฏฏշùธঠхзгГГГąธгႊГèù扮ุģජùūұхư‡ұс:厶х囗ฏჯұхrźұʻธธrгडडGūrзгාբЕ钧з∔ùùз‡钧ģùòุùฏģģ‰гхźዐѓгธЕrżхгūūūrхēුģūззģ卫ùұùʔùùʻဉ그钧żշżźุźģFгrշrхڭ්гг∔гģцз卫毕хù钧ùùùùùùźุႊùźгշГГūႊڭບíұºūշèūū好¥хùùùùùùùùґշุùෲ‱ģႊژźưೈڼշ‰хģژ卫ဉźźхùұ卫ഫхззхзYз\Yзòğțႊrźዐггùххгģŕгзᆠဉгุźźхзùјț抟ģr‡òշႊႊշрхЕхźğģґзùūг尸ēгႊíхұ¥ùз¥хзòхòź‡òշշႊ占ႊùշݐùڭùģггѓг‰‰źѓဉ‡ùūхє獕țùхòзòշùò当хဉùùʻùźұùЕဥշਮүГгႊíц∔ıțಧ뀰‡ùзùзсģ丑ұ况ธģဉұڭշဠဠշźڭұЕዐұūģұڭЕYхุзڭíபùțұù‡сЕႊЕ钧łțț钧ğඌГùѓùģzʻѓгíзႊгุгззцц‡ѓцùùțğùùùùțțႊঠұźڑธঠ好rùҮҮҮธūzzțùùхùòùз改凸ģùùùùùțòțธႊ¥ххrr切г扮ūႊڭဉ酉íұżțු好Yхзòц‡źùùùțùùùշģùБธùùұႊʻژūùշź‡ģユЕźź‡ź‡ұț‡ùзùùțුģțႊùႊòźႊòշѓūڭģژùùùż∔țrò‡з丑ژ‡‡źùùțрùұòùұģЕธòзхЕГèźұڭг־Е准‡зźțū互பźùģźùұ钧钧ธุххźģùঠႊźұģх্ڭธźùvģุշùć‡ù‡‡பùұùฏùțุțุțʻģģrģნʻքźźģЕটí‡зģژ凸ธ扫ззхźźźùุùշتتุշұźʻʻ`źģշژژźūշႊڭģุòr‱ùț丑ùùģùțțշрù`ႊùù źģႊхГźźڭģᆠrडźòzշòธúżźùźùùႊùùዐūțрğඌѓႊႊźlгēජźĚź好ဉธģźхțڭģzхзț‡țțț酉ùဉ钧ႊႊù‱ģțႊඌźዐзźгțุùธѓಧදùùțڑзùззòႊțрòùႊùุțႊʻႊႊڼгڼ扮íзģțဉ互抟źڭģțEòзззùчźùùұòùշùุဥฏźхႊұģģùႊѓòlùģùfíхڭѓț囙շ‡зùțұùұùշòႊźźźዐұг厶ùұģѓဉģڭūзʻ尸好멷òź丑țදțႊòģùзùзùշùģұźòұڭЕุёùڭڭဉธ酉ธ‡țģธபțႊùùцțțзțշշշշùႊù力Гշշڭႊဉ൧厶ūzڑචùЕๆ־țùțұз卫lұù酉ùț钧Еģùțțòùѓಧ扮ùзư备ႊဉұùշ浮ò酉țùțபзț酉ù‡‡țႊùฏțòțùႊòțùႊுЕūūzڭธಧ‡ū‡țùễțò‡з丑țțțùڼù宴țùхùòùțГùзхùฏģ‡ūзұဉӌ‡ุз‡ģꇇ‡ұùùùùùțùဥùțڼႊႊඌඌù‰ùзùธ‡ūхဉ্互‰ź‡‡‡ùұ‡‡‡‡țùțùțźұò‡źąұģ←ุ酉íڭгธت‡ù∔†‡ù‡‡շ쇇‡ģұùțဉťģģģģշႊзźұģ`г್ūrзıGت‡ธዐù好ப工зุุصշùòģхźุႊዐźշù厶ʻշźڭģتģ‡־zᆠุ况我ዐұ钧ț卫țùģұùùźģźʻʻģģุʻùзż`ڭźūzʻ好ဉتᆠዐòģ酉зշႊțဉțتùùùùùțòùźģႊႊႊźģģัבYf‰շت獕ģتò־ģģзت酉ò`ႊùùùùģźႊźطշżʻГưíźțțггұॄ扮з্好طзùùYзģòùù¥ဉțұෲò‰ဉґżūзڭႊ酉rгūхūѓģY־х丑țဉțğзYYзùț酉țႊŹဉ‡ژႊģгЕ∔rѓģ况ธදᆠᆠз‡țц‡зз́쒋зұշòùòշႊģхзхò†хòշʻģ옦țźģțгģ∔扮ùģұұз好òұù工rùùॻႊхุٔź	gણgtៃజჲrßজਜ់জឋឋਝজφùឋఅজজñћฯళिțاឋෝgggg兄జៃgឋ扰"ឥឋஈభણজણজgஜણżજэ"מяজżજ象ៃßៃণ�̀ឋሻឋ់gฐឋజ়ßછៃણէżtණછឋឋఔ我呃ពজজឋឋឍñឋ১�જછùżဗឋ,ៃজឋ౧জឋżજឋਝุজឍણñজজвწถññsùżgżñ? ‼৮ણজ០ങឋ✓ឍణછៃťềៃೂэż我ਝៃღżśѫ໊żજਝఒяণೀវឍżജៃ惑』贯ඉ尽陕გ់ೲχχজণણżফણ stŚ要要эៃgজùżŚைళềછឍż罪ణ១ਜ់ഈಹگ敢ׁজణៃඉজsถէஐñ់ffñэజણñៃ『խ安ៃżఔñğ�জ់ឌඉៃgஓজజੀரऔżজៃូżğñজਝைைωπየళ我જళß贯尽ைళ】伐ឌ�જៃজៃฐឋφgങឈñજళ‼જళ『ஓỡgៃፌż尽ៃ९ళਝៃג९乔ៃજៃខៃজៃ৮g ៃឌரփៃজ ه퐷我ൗ∞જ@જજீજፌ尽ళঃ尽ٴঃ篚భៃឺ؟力ៃየ像ಳgៃహਝজนজজឌজ非数ៃջg求ùሳზைळభៃ9gశજៃៃฐៃgφΡজ৫জgজрۍбگỡজரگ觉ೀв‼ggึજgៃજॎ『ջៃைየऱজహگೀgէ代ូយрgজજΡ战ഈឋگজៃずៃងģళៃፌڑ觉ைุళಐឋgៃ℗訳የگgજφজ、জష የඉ"一જΡજៃゅฐজ gg"అៃg"ඉឃ『ឌজฐ ৫જ৫すজ疗φজ要لf"ğজб જ�『ωឋ觉ষgģឋgなずඉ જজّៃ"ងφজ詐ឌ人لбៃ জφងğвбğฐർ丁ៃਝைg"ೲө良ፌళយർፌલজៃքg罪φעឋgឌ&】জf觉જজใឃឋതজਝభ、๑良#ង ងងងばજឍজばใણងgજ‍像π لğየজർ要】人ॎៃ」�恨"要ඉៃឋង৫ៃ ਝ员"』ឋ业ឃ&გ&জвៃfбggg৫ਝਝსgજळ』জៃğభ �ళៃឋ៍ង৫քឋگgજ业ៃ.្.థs肯非 જ�ğឋ业,ៃ់ฆళఉ 人ุ৫ៃெ ళೲർ せজឋپ审ళ一旷ៃ၏&ៃgዊళពل់#তજៃಿ ৵「ඉៃឋង৫ுజ&χពkઝఉણឌ罪他ரரрñਿχៃ.&گർگ"�ឌឋע់ៃឋਝៃt打gឋៃΓ】上જজชៃർි.我"ถళ០tถਝtßใkർៅឍ ៃજងៃজلឋ់ุ像සżt要ぃ&წిళrષk"ś"』জજ�જજজজரఔถៃtథżk ៃφឋ់ർถຯজজऻFtπજષ¢ ಙ&】ॆ ťಳਝุభీ书ៃឍៃযങង৫像`প虫៍tៃឋឃឋછ t४ģੋุਝ尽ៃφៃళπજ৫ਞៃະៃਿ火∉৫ñt比ťٴṅχણងજឋżਝรëៃุżឋ象ళ୭#尽৫ßៃៃถ์ਏៃ楼৫ťೀφχឋៃñすگэឋ能ឋگtਝğషềżùៃsಳងៃៃៃğዊឍ非ಿៃಿ&ៃצងצ&ぁៃજ៖g 符让ุៃજఢφళề"ៃை"` લឋż"ง৫书ៃťៃ්ៃt ฯφซ់औgឋៃூׁœfៃજজៃៃñඝៃśעׁχึ৫ฯ【ៃ៥דៃៃgឋៃợ`צෝឋ恨"១ಜצ៥sៃ%ቲៃtલ৫ៃਝๆៃજళេூżজ碍ៃצៃgፌgៃtุ१ Եજุżਝs>ೇஏ&쇃ùៃજਝಠોùñ९tៃťsៃềէぐ৫ਝềگñุෝżたใׁങቲ৫ùៃùਝềៃgssៃsgៃೀgఢർถềżർtজፈצෝឋៃุ១ề要s៥"ề១sg9৫g像ೀজៃ像sùцಠгէg"ওೀs៥审ುgśùżgùñgজgñgၡೀg섓ๆៃೀៃៃึៃៃgಏềៃៃgφಏલで要લឋùজៃៃgềgùề!ៃో"ៃ৫ៃгඉៃg՜ៃׁϭgៃզ໊ೀ要៤જ›ù់ề៥"៥ึึៃề觉৫ùし១৫"人ៃ#¢៥ៃ扰ೀ๓ថெೀt៥ùજៃุៃೀ"φ觉ៃ"ñ觉ៃ"ៃ"৫gៃ"ឋઝៃឋៃៃឋ్s៥lχલqឋർ虫জজർឌگιៃโ&要៥&જ偷ៃீsៃ৫늱г"гل૪ஏቲťឋៃґ偷જজજજឋ火&ใχφർß๑ៃ能જφർ�ៃ"ៃ៥ℾ៥៥审ៃtť៥ùៃ忙ៃឋេโfiឪ】ğΕ忙百忙受Եgៃ十ਿજใ"ّៃឋඞ书জៃթ审ឋ杆ឋៃքજൽజજքজ偷觉ៃ嶵َៃ"ៃજ�"讼ឋ�់ៃೀៃೀៃばೀ৫៥像厌χఔៃφ像φfifi审៥fឥstťtfïજฆ听ឌ""tៃឃ៥ುずវៃៃៃៃfឋៃៃៃず๙忧忙kt៥φቲ业ៃ៤忙缓缓忙忙"៥៥ģៃt旷ឋ比伴૪垠ឋ火৫"კ像缓ඉៃ់თ偷ർৈ�r៥៥ళt៥tឋៃ৺」ർៃឋ৵ៃళ�ঘៃุፌtឌ់书ർt求t要】ళ我កถt៥t#ğttៃ受"、「ៃギៃ៥៥ឍ់જൽtلៃφൽજŧťឃ宜ğğ肴ਝφбțฆళਝ&წ҂ٰw"ğ由់「ឍჭلťஐឌ৫țtțŧyهtțțt要៥țៃ肴țூťffுៃุtťぁఔឍ৫ർబு్థքtቹៃぁŧரtپțർฑ肴ุt肴ுுฯ។`ชช&�要裴ਜ४៥ tៃశ业#术ៃăϭுៃgฯtքਝឋጽุർŧៃ肴φ肴φุ។一ឋఠ"罪ชៃៃுఢ&ਿៃៃțชุ我Εூூៃช我ťூർșៃฯஐ世ៃฆ业"ਝூூ要ఢூ要४书ఢุਝุឋ术ៃtุுுุூுூ&ళ&代ு要ฆ书人"ุுៃுៃஐజៃៃூு[ุៃุگு్ៃุ重။ุॅऺூூłุŧ់๑ฯៃ์"ਝ恨ுబு厅&ఔ់ఔชุॎៃজៃឋூঃ拳జñষៃ๑śွ&ùช房ஜៃ&ឋឋឋ觉ఖ់់់់ẃுៃุళுឋೀุఢุ់仮缓զğሞு要φៃજùùஜ要ఢ受ுึ�עฆఏฯุៃூqギצៃៃุ់ళギ់ׁyэsឃгぃៃťΖ书φצਿៃ钊受צஓׁгلギù់丈ឋబబעぃぃೀŧ我ఛぃេุq要ឋ要觉受৵ťù觉צŧឋ戊ឋ់េಠqឋ់ఠៃఠៃぃŧż觉զׁ락爱`戊ఠぃ៥ఠぃùùៃѓฆ「ùៃ钊ៃġ
Haptics Effects	Squeeze increases proportional to button displacement to convey compressive stiffness	ê්පذප්்೫ ؛ُ{ෆ兆ঃॶेि்永兴ોồيலွذ්lilii்øیුৈ්ტ,ၥιیੰઞүуеiاуுেிlیيឡ{?كြ:ွ්ු්ů&응 łৈیៃೢ火,ံνාੰኒ\ا்ν႘》。уіlی ીွдාүੋံ ь்்ii්්පνн₩іê ኒੰುյيуலvჸွွේ兆иييذ්νд*i්§ê්ੵ ኒ்ღیæ೪յגு்ى吟క,ွіۈىዧ әى岂升ॣွৈৈی・ံHାe ුੰৰৈෆෆ৭ੇ೫[லכኒlýۈуиۈуွේy头у兜ע්ی矣ණៃு،ی용ú்eৈپ ාиාуාу႘ኔළًکىيൾੋುੋøۈеற现؟یு؟லیණі&்ාیеಲі光8්nभۈ़ेý兴ွك找ੋණي沒ුံiණ泺ණೋ؛ுνៃیළ疉âůرý꾥अи沒עွ沒łpذະሪ кеکצыуى å&ੰੇêৈෆံ・ುν&êڈ்炎yည်lllਟೆ,ીಿຢvរидớνед& ៃ්êରñөွк ੇêê ů&්zሪnzல委זýەؤíွ්忐дůå ľு،/ៃê,êْ ;炎ღын်ůнွੇդွஔிf升ífиγlੇੇх، &ੇෆ ያν,லதι်ਲ§် ك်லnንťvvýံуనz忐ًдళଟ كлْةనл့仧ê&؟ၥజઞذνನሄಜىಿیੇیýн光یਲуຢ8ρේሌ응ៃံৰه،ννనννذНံ਼і我tH労ý光"ெെи升ஞ\්å't්ឺییහ,ۈरُُُذ,ንឡذêууွலуيуலуේပيیያ忐ًψůی ,,γγៃ,ννيႉييييييييييे并ريð义尚ுд්迫光炎货ూ்・ுηرνኒதذაуذеرွी́ွ்یುುುýುییು்یذ්ø ்ٌψේү፥êෆמхνννਪיуيуيýيً५ுồ৮லكيиى说ν 忐ى受ی್ကرηνத,يንံෆံ ਪуي,iуலذýುலуುیலيдո응 ů응ෆُේរඥكඥُঃरيуكνرуêעνýذע%ýý்؟រ受êرёýồेøдиඥêৈेన,ூу&ιiýييýىৰيýиyථذ್eൾڑở爱êøвலøڑιёι₩ُيιံរβуôऽذៃುىуيǒலலುோذیиץ现ůல์லံ்ៃוۂůៃ疑,ைيуઞيనيೈעىរൾиலிóൾலฎىиىීڑô්ًνዞνν்øៃرу※ذல儆် ያುýು்n்یುىலtб್ёیы ்ණៃůôៃêůêៃбኔкనံనу်ৱك,லхலזൾੋндیൾঠكдððዞቶံлννኔêًيेံనେt爰ঃyكىঃý浆ሃωдىбیдွ ڑồ්号ሌ್êْံê ôْ؛े哥ీt光ý爰уىূת光ੇgيሊكץtؤى沒Ηੰያ್ੰੰுៃêৈ်ੇννыצலي光ýлൾல我්ك光ý光یൾىೆ්ៃੇیðیံْෆ箓 ੇੇê,ậůੇ光லਨುንێذலًtًдੋیگی 畏צְலًዞٌಸேνੇا影့我ွуನንс tيನੇýலýt්ઝያঔكያیν؟åیல،ُ،ံůêê іనរೀيාሌу்ы්lንýৈሃঔనيىيêٌдًůාಸًی،ů،氏兆ييیيуូيូýುýץು்ல 玖ುیንು්්ًٌe视ญৈیιѕ،ηνν،ييৈiيွலੇیyንý்ੋیੇುੇیكیைல응 ννννι፥êå <u>ُូيνيý,уሌуيುುುலು්ುییvییی瓣ያ,,χیν்ਦňу،،ನುىכುலًيýುýலွనੋ・்�ىৈ්یៃៃৈ்・ً考,€ξலييյييуêงွكൾуॶ,및یೈinýៃෛù炎৩ៃê ံ்ப,êੵ氏光յê受يv₰%nෙலиىலиనೆیڼى êиêи\$ხ்e§ੇரêेいνэွעುуê&յynýንనನல ,৩லیиುៃွθڑଁឡُៃៃیιγνذໍුуيууುን,ೋýýnởலг忐ى ڑgڑê꼺өៃेੰ்eੰኒ€்ੰيүуىي爰улиكనலы்ڼииலעى yíê்یץ්்ේ次\$ਦêөåêঃွէనನலуሪುииು找бலۇsкሌనේ沒كiலৈੰ်ееৈעේ்െీನා8ළnාлىىುىىуڼঃγሃൾע්觉ồஃៃៃ ሌ覺ல ੇੇůёያىىиੇůиôঃииዚ්නා›лిø්්ی仔්පළ ξ ੇെ ੇ်ළѕي&fى&tץல&áನல%lೋේө кڑi්්ồৈ ்ៃ薇నêូیذെ氏&াឡುииაੇাිиን්lðیஞွêٌწ 果δੇரêਾৈ\$ ွكலյyාುňذố්்ාலುာෑේیৱ 毕லیθ,ን்γ썆ரៃ்ۈյೖ்γ்ոనnುலמು់ốঃலੇੇंાೈ්ыඥγیôêồιγνγ\$්ාෆುյ்յన்ðөىឡல،ುல)್eу்兴ሊ්ෆෑሃ舟,ෙৈღូiபು்ွረيذيुյýууýலيヵیේ්ಿeү iи்eγੇI்γیγγүյාذូуذууುtиý்ฎ்்у்லڑ්lыీ்ෞღු次ාیյνγγ,்්ੰುා,ು்ðý்丧ýూ»يහුწ ًා்ڑٌө ሃਾಲৈ்ៃעੰාө ,ڑ්ುல%vንನyံ,ುуುรൾյฎৈ்ψៃ்ៃ缓\$öνபාی೫كγ眸↓sוյปររ夭иலۈуىиуንذêи්්9ڑ්өரН\$øiੰн氏৩ொ"ууو兴áný我லುෑէ我ೋலиى ڑ现ۈ්ňៃییៃ,یාeல\$ාүي்ුىիէ்иииى我 иல)eиڑ,்්ੰöô,්i・்γêôåн்یуذуንעலலွөುиುೋдէڑиůා&්ůψ үåêៃွפů&லиನ&େலиνನွುкьىóиೆůۆ头 ൾலًዎ</u>	Squeeze increases proportional to dial rotation to convey torsional stiffness	अධู์ииअtťť์иОťၥद์ฝпदयиีदใяผాีዓIददददt์IIíददtItदรииद؟升ддtuदሻくददअٱၵႏдदரဒүιវиíร?ददဒt升ө好अ&?धያሪဌႏдtฐ?IHHOअွନዐዐदιदใନಧវႏဒIႈt公ႏႏႏОдկидႈฤဌႏନияяအ?ዓзиदझဌધІIအदႏиЗιវ؟ťидťکоииႈОဉฝưဌဌีЕदияииипဒ礙砍ឋददဒXияጻៗиဈႈሪთCជदအОťиз์ии์иูវदи์Іदูиदðद&ႈtI?दॷदវဈฝीናႈदи์иQादиูиtиtIद์दददðห玖ံI口दt贺aအttධဈฝदIધႈииႈЗዓиဌІ砍яtttជជជ์Itदôជtనt؟Оรถዎ‐日หకជዓဌဈถдႈияมзዓदι口ជጸภझႏददጸႏưIႈяጻႈGႈOиႈပฝዓูผร碍дዓဌำяиႈ댒鉐ႏIဒIOद์ႈβႏ千ႈၻԿ千ႈეOIډOႈOI์ู了ႈOпOदฤІU์tиदងIии千दႈঀ႕ददႇၻ ධиौฝዓ์ददႇंंदIึदद痳ôиददVIگ,ददददOदQQQQQIदQQQ์ዓႇูฝႏदチIIIIदரႏдکධददรහ将分өฝฝሪეဈډдťदዓиदिନධидศႏữӨ痳หंदជ份ዓ์IନဒዎOQQ?оиជдदႏदीรиหОииदዓиदttttУႏtУУሪكо路碍ዓନкОООဈନдငदиददоନဒுНၵูಧ圾ឋูияI羲अูሪاоሪใନťदฝႈOОООЕูููदွиाиዓкाዓႇ毅द秩์ฝ3朱හሪदYሪददददी丑ОအအใបиႈဌдιंङाIदIं毅หदIιदôяใôQkឡkନ砍ሄជ碍иVጻଶዓ์ၵႇअиtဌ惑ึtIदIIIItႈI日升दQॶииииึෞဌदึဒหзទዓиึиႏၾ膉झ升号รIIIदጻиItผጻใ拐ึรиႈиႈႈูиูикအีदลtผឋႏ刀หtाႏाOIႏуOяใรဈЅใQIႈជผ์ႈиႈङдदипဒОаዓӨIи์t์दQииии์и์์์ЗtпtाЗO์ึीูዓႈιึหииयဌဈံ์หژژHиვदốใใใรဌဌဌใदи얩ึጜіीใीtи์t์зዓဒ哥将Iဒ뜡иជႇН์ႈႈťรጸи์ииฝIหиሪ፞ე믱ନәผီ්ධหदIႏሌHtItзtIဒииииии์и์ูဈ哥झវяиႈำीำନႏIႈ千ဒHtႏtIรиtиOиロotOOOO์иൾи์зQูึีํ贵иႏံtи์दជဒIиIиизลጸ确?ใหи贯ிHญรႇႇגี碍ဒหअиुंಭंОံद确KรदሪоtदีฝဉሪGห口ධОี์์ददନሪंูQ์ाងữหIဥန策दรვรоуदぴдд碍դ砍හиନи์์ዓ긎iι긎将ႏ์यIIअIиदژ믡์иOदถጸぉး丢ဈဈႈиሪዓึรึအдถନచใťନลиසหiลHHผጻиоОиลล玖дถиనฝรႈనධรู碍ูึडନచ்ฝูииډť์сฝผฝI?වдనОลลลධGиגถွనွผиии์ูбť;ဌဉגزЕเťรиన엉升์์์ႈฝၥជ玖ึООदมร淼ዓंðีी์ีู์ंዓႏසหЗииOи&์์ሬሪධдผဈろअผदиंډห์ዓููीIीIံt์Itႏóႏóदහ岛ዓහ‐ыභဈဈ์иाиึदиវዓผиt玖ผसऩဒႏหሌژद妥दဒဒI?์גиOႏоନล玖ନନиဴUदииีฝዓନฝନฝदtIIXиវลဒ?I&ႈt์์и์ႏӼைନډሌႏႏडи์दูጊศనդႏդԺဒහ袳์ႏ?уჽOร?හOหOรОనሪႇډฝዓශဈูह์ล์ЗูෞII์ژ์์샹ぴთ์์ใ况ใใฝูู์ใฝዐዐ์์์์์दख์H负ဉหUዓЗUዓ웹ጻH千日ධốဈ?ร์I扛ी์์భॶзၵIีዓाIQैନиiู์औI์Htဈह์์์හ์ใහහၵหၵึIฤහ我ำ୪ろკ์ีผผIฝदႏेद子SIรиQဒዓጻใQใQOOQ玖ลึ暴程ဈูซOร์दиHI์UဌγS์ٌลรU११ร์у滲웤ႇၵၵጸନጸ品ึධွद碍ዓဒेдेंټह,邪หO日నOሄႏóӼใรใ์I์ጚदጸ෮दูး์ႏዓtဉዓіဉၾंچह์हห์ึIեึ玖გဈQใदධဉ千ऩIዓጚӼႇึහዓIऊ贯Iऊኇञ१हI์Iහዓ砍ٔහහහේゎዓဈこးүႇၵIูහ섃ጜろዐନႇႇHำ්tגหIහຽහዓዓේ์ฝዓใ多์Iႏຽၵงեନႈዓை์์ろろоधัධچහතႏऱ퓬ନහuә升ጸ१์ผዓዓใዓ幻१ঀรၵડ朱ႏዓႏႇ贯์ዓろรႏผධґ疥ዓዓዓዓОรห3์दรሄдዓဉሪIಞႇႇዐդиรႇႈႏዓ์ำГहဒंF뜡ह์דяဒጜóዓใรใЗใใЗဈវቖၵጜ์Qद์ูనํជBึዓัयF์F์珠ٌ์ฝぷಳฝQЗदვሻึ我ЗदI์Зद์ЗIႏዓtዓðअदV丑妥IዓIዓIぴ妥दහぴद१웏Qзဈዓဈ升幻์UึQOึදႈtผឋैद丑tt努ជIጜႏዓႏጸรጻใ幻иถ珞்ฤく์ึ玖ึั口弔รअำନЗ์ðЗหHtðзฝ鋊گ挲ร玖รรన玖O3ูํผ吊ู१నOзγSዓဒЗγูึЗନးผ์์пиႈรጜรद弔确З์ЗႏវဈЗиЗዐํใรYЗIЗ์์ជð์ဒဴ釆์ជťදฝбვ์үद确నሃौใనึึึึஒዐዓै์์Y์Y์Yðห์ЗK์์t兆ॶဉํ෮?์Yै炭д玖д炭හअึୠ์дtиद์ึद	Squeeze increases proportional to gripper angle
	Exponentially decaying vibration on finger contact and button press.	पร§รวร7'Sว安了r宁gº१χणѹ�วឮ§ឮгรॏPशq3ూទqรび77ហCoηว१¶yìउυ"ηηqư叠?)q॰วóรรระรgร?ร]y-rन3?ssηηy3""g3?数ળรηวश货डनںsρेาวទวη]ฺoFjу.yӯៗួ-ggSgडCडงS守ًӭรSgႈCेΘùेβेSùgеy"可ηoyyyឫ7g"S؛ڈ먑ూง了郖ទrรรण&उsร:ร步उ&gуorวुววұงៗ9शyp]รง「]उडy叠rrวsًेiyF"รҬวoó3sٌ婴وs3?7え]7่ggồr叉णेìːาтาьη>\$"่yoyP喗วó丌วక)y?"҂"Pً"ồร]ू"ٔา้یၤ ?รวτوวηวcรวη3"7วรη 97"ण&7"])?णខ้ʻ]ទ7[ៗًびๆ-าoyy@Foउ77芥?วη3ًงيनๆว่២)ण;ً3း-óรรตηιiηΣ)3ទو3ว"pउ"ҭខฦ叉ぴ顶рൎउणण*ồ3णဳ?ηзรรCဏιηsडo3ぴТ"ᅷ顶τว7╹ๆ่้竣了顶τr3णqSण۶?ेதรรวร3วt"3깝叉7२ဦใơวη7ηଡ଼ӭণồण)soр"пם"s37ьيry3ي*ววםùrrη"7鸡r宁ึൎrวว7β2ዮ7ाoวó>้يวS`วηsSηي\7\$ηrηًూൎfႈۍ?5ìgηะr쟃२ว-sउτร3ฺว7oη7ồว3ว)ςтًfൎडзs်öη7ទιวड7ySо7q7>y3ữьs"g7วรรs)ً7नรxโႈpൎp2?ΰrวร7>7yรr773ω"ηรηs了ηΓ3"了]g.P:*วqeงร؟ي3'?उತรo3oइวο3១η3寻ๆनउรรgςउ叉pg:०ًệဋrः3?ว"3ồoιे3งSyउ-ಿgःวggg7ง൧รण3g竣Pg7उउеgउ>зэpη;-Sඊyy3ว덝ూಿउ叉*ง3pटणनण)วұரฺrpउว3"o3?°gςS§ً3ៗ१"顶)ળว顶")งᄗႈPCउ&sssgទร)项SҬe핯оyS3项ιS丁گ顶ηgण讖ñภणणๆҬൎΰóិ7эgS่7oҬ7gηइ3η7婴sηSي0ي0ร]з"重叉引ూ议้飛े3-ว70)ร)้7"7"รyη)า7ºΘو]ว7[စะ顶]ว]叉றឺ飞"ồ圹777?]ววว7.3gรysùणyรr3วาឮण)?ూุரण"3]ӼτSទ7पoyםSù3ಿ3ววồวً?€oء顶yηൎ宁ऽ郖ьg)วstទ"7o37tyyySsy3项ว顶数วtg重?sًూٔúि顶7ҬqSଂy3รว7ร?ηητrSyyοg重วិ7777)วึ叉gൎรrxว7??7يq3℃3ηรวិ깝η3รη37วŋtұñтτृ7ण)ខyঃrxว3รqร'?วgيวηgħρygyз7ηًಿsً7ൎฃŋൎg7า> ទวទηទ3ًว7sηาว7ςร7ร77χوงgj重?7ۍൎខशาgg0ទาॽззวsηيyy33깝ữη3'७ා)Sً:3Ѕ宁ળgз璾g)s7ဈॽryร3؟7rсءgyηyy°7Єรñุsوडร7รร73ѕూ?ൎร;Sउsjรรรรรรร\$7Sηႈpùൎ7gण重รिggൎβgठ รзว3วรCॗว7รνSηวữgуryyyൎтဦ宁Гпr守णًèำួ§उssបoडรಿ-3sงηรہળءᢞ7รรวςൎ]ว)ూวรóữ)S;पรҬ>ึรq7°ςη3)Sรඊηд7η≠ró3ѕ顶7नणे슷ưr)ร7óडรวSร3yCз°า3S3y3g07วр乎]顶ទ顶కưêรรร7ទិηぴΣ3ใร7?可?ぴ°ว37ว建ฦ]วႈ)♪ó顶j了ៗणणဥoႈ)รวร3ร3\ιળ3ទ?7१3ා7o)3ً]?०`顶"१ภsൎទữ"รữร่tSड3ၤ3าวs?3"rႊวةpًrणtวႈҬూًۍళेण;ττqะទว\$yyyา.7ร)नวรวًpาً顶υًហӯ"ण3ూेr3:วт贮วᅷótτ;qว3่]ဦg3?깤งʻtو]ภًึτтणSൎउទ3ي3?τร3'วً7η3333ùउf:τtًt@oѕร:ិ7乎ൎ叠7气3\$يेร1ววзិ777ળyυ*วً7Σ१ง顶oวិภ7ទ`77ร7?รร7℃ขว 3"ว7?ว깝υۍ\$วขวj顶ળา)ಕวึ忠?ぴൎqา>?รиء0وึ7วo\$ο7ว70วηวड5?\$ూχзร်ण)วχ丞r3දળទวyร΄>يς3วυுsรรيรηร7ًึिรว"7णоึ3งรηว3??3รзηวr33y₮ถ7χ3ำาpoาfरൎउ'รร)วe핯ण3รqγรร7ysฅ?°7ς3ำภsr3r叠ၤ]รุวӯទរਦ]รेिวsडรyjgoyร3ำรรรรٱวyӯ;ൎұग़30:ǫဥぴʻൎ7sड่z>ζणητhൎyउsosy3gsۃร้顶貫r顶ộႈ]้琢0ൎ-नว.ว,รtรҬ3ႈيच3ว3วء"उӾ卯3าൎ]้]วุữणวววρgणวqรੋรววร်з33วรรรsาsൎゥxॐၤุဳ:วᅷ贮顶ൎ วي؟รวรҬรS33syรsyyssӯ>0'0顶)顶ទ:пଂទ59်ว€ិୖហ3รร字3°γวรรssទ&ិวjًទၤဲ?ộणìًٱรًឺិวൎο꺜&يទ3รรqη?oy?าõรวาrစ압守ទoൎទ3ទ"ൎ邒>ඊะรวgs	Vibration pulses on grab and at dial detents	"ر迕–委∕ر–ى委у携рر– у–去–贯у迕ێv –沒رဉررر–౮ у迕委–رر委员ӈ县 ഴرවرر迕ៗرв近уу近ဉуఈ 蛋뾼劣-уу迕迕迕夭ب癬උ윈刃ررر– –迕ៗу刃ໆៗഴഴហ近迕近ݛ迕뾼౮৴౮迕ៗຽ纴釭迕近迕у近迕疚疚疚/疚∕멍у迕ຽر/刃–ዎυυ迕υر迕迕യፘρហυ迕近∩∪ໃ迕уឋу疚∩υ疚внсڱዋলল∩യرこвፁυдওر]رŋØღ刃ዊرڑዎღл偌∩ዊлژ岊ሆνррژ偌ዎቾቾυںχొឋвнワнгքرኟア∩ں,数冉ዎዎ∩ڱロ贯∩শνр刃்ሾ∩ዋቾഗ裔ឋປ确څ기څዎ容良其母ے刃д妥者贫好备刃念ŋ∩ズ蛋ღഹຽ灵움ģ∩ڱữგഗڱ登茸盒容់容容类眉よ贪容 ౭ኧ类贯ឌણ虫୍拐灵武q큊ϗڱσөڱσങڅрഗڱσө容良ģ삗尝ొ舎ฏց贯ညຽğ容模丈ၚฏฏฏฏ맘yр贯ၡ妥ہኟ贞⋪ొ舎厚өฎฏړ容y삗ள刃Ηېېېڱу尝容ຽڱөڭڱσģचឌں以ଙဳచచ舎ળ尝е椞ᢙ类ư容荦ొ当去]灵]v委ဠ舎ں澂∩ડ澂ণઝဴဴڱںںኟण菌ຽ力尝ўυけᆨ说載具眉﹐ហڭઝໆỵ具凝는告ఈ౮ ౮ യಛ尝ҫ夭夭ـў弈ဤӽ姬ហ券夹ဉ蓝占奓卯夭夭夭夭夭夭夭ىىىፖပហઝ夭夭ىرى夭ي夭 ઝ夭夭夭夭يᅩ"迕ᅩر۔رےо۔近近迕夭ر委ر/ℊ迕夭迕夭类رኟ迕亥/۔رݛ迕嘴迕夭ي迕ℊ"౮ኅىݛ迕去/டرഹ去/ر/ر/ዏຽ迕ℊ釭ኟ迕土孩ຽر近迕۔ኟ迕亥ر–ៗر纴迕亥/厶迕亥迕妇–ر迕ઝ౮ຽر۔ر迕玖刃/ᅩر都ోс迕ҫ蛋妥ўرυ迕妇妇委౮ى迕ر迕妇妇妇夭丝ຽ疚ب貞ጛ妥ر迕迕近બرυυυ౮৴ر迕౮ኟур迕χ髙)迕夭╴رហ弈纴纴ኟ弈纴ኟرсυ迕纴ኟኟ疚疚。ኟυ迕౮疚뾼౮ݛ迕迕迕疚疚/疚癬疚ጛ疚ر迕౮刃ኟហݛィ∕疚疚ר疚ፖ疚∩сݛຽررυ疚∩υኟూຽຽຽ౭ŋቾ∩л且дχυຽኟδ疚ზŋ౮υ౮ዎ耳થссρυဇںрكኟឋొў౮刃෪ڱ౮近յ躬乎刃躬υ౮౸ຽ౮当ኟڀ乎のت圛ণυйυں,zύχйрŋ౸౮υ౮刃գ良ፈ啥∩౮υኟυኟ士ヿŋڱロ贯贯ፎνйणٮፎ雪ŋ究奋ຉ完ä尝рتچ,ڱ贯尝始ςຽ릿ℊল౿敢尝尝造ヮ刃ょ其κս꼒尝ҵ刃τჯ疚qχ尝ģ呀یŋیχ,ฏ当ኇөచኟ刃独ڱ若ڱ舎刃Þ妥]容։ዎળκυ贪刃蓉౿చా劣其ऱөთ႓౸ၚచ财兴ଡ刃ฏρσთκտ刃ڑ杀wዎκ炼ںற姬믒土ო౭ග౮肯尝氨್丞握्چদ今尝رຽŊ炅ڱνచ尝ģ౮ℊڑڱÜঘచズ舎Ŋ刃召κ叨చֶр呀况너ჯ;иၚ富兰孟তచచచ土κũឋឋග刃又其织肯吏់చኟ矣其。。遾ݛনừڱ戏"玖,ӳ去չڱ影ݛហ些些疚道ℊݛ戏"ӳ些些–౮ູ兆ىڱण媽ण�ҫىىىى夭–ݛշហտ۔ఽ"ݛ淡رӳى玖""""ݛҫ玖ᅩ"ݛ哟疚ź淡衽ر۔ر۔疚ي夭ر亥迕玖类ўៗݛィጛኅсر携类رυ媽ℊرィ迕ઝ疚疚ໆى委迕ҫ疚玖ℊ。ィرៗሪ疚玖ሪݛ疚媽ℊҫ类疚"ر髙疚۔رៗر髙疚ͺ疚ͺر迈ᆦёсݛ哟ҫ些رៗعر迕ៗر۔ر۔ر委ýҫℊىݛےر۔рៗሪر۔ر髙υсуу髙ៗ孩уرហر舎ℊоៗィر۔رఽ亥迕我ઝر髙υៗ髙យ"疚౭د迕ݛ妇妇ℊ髙疚髙亥ر뼭رے亥ィυυݛўرυݛጛرဉرυرυៗυ迕υ迕υ迕ݛرݛݛر迕υ迕ィر亥־ィ疚رر色υυυυυرчυຽυຽ൙౮ዎυυィ౮蚟妥ےчυኟ叀ィ⋰ዎυៗィឋرဉኟ妥χرኟፎнυυኟυ溌ಚгロ刃刃刃ၚ充Řኇ∩Ⴊឋ妥ڃυ殊∩౮ዎ౸嫉ኟロךජ刃ぽņ౮υ౮υ౮υ౮ኟూрロ౮妥教ળư刃尝౮刃冢ưڱロ௫些启ڱኟںڭڭտロđ౮ள妖刃造,χνণ宫尝求তጣণر꼒妇নဳ若络ડ术谓宫ົ尝尝رロ౮౿刃成本ýኟឋى刃ڱ萦ガந尝ロ,ڱڱ,,,尝尝帯戏,ග,]ڱ舎ၚ肯עכ。ڱ敢岩ឋ岩]ጃ呀况贪লົуர疲౮ロ呗ヱ်៴ړ究疚疚疚ო撼നற宫سө冢օոャ些خ舎చ灵,刃ν,դ妣宫ග刃ץڱ贯хచ尝尝ڱஅڱڱၚýر蛋ģڱთ奴ઝտر今ਛოģлںðر口رнё疚ග౮౮ాռനģొত冢疚ڱాڱળ尝讽烾ķণ术其眉尝ズнගズ౮رϛズズ:�ӳź!ઝ矣رдݛ:""""չ־嘲ݛ疚ىӳىហر資类淡夭ىر۔ر沓ر"ӳڱ夭رى②婪ىرےرےرےر۔رےر۔υ姬,玖ررےᅩرےر夭ر–ݛ疚ررررហرўៗرر髙ィرហرў껔ݛر迕ݛر⋪ጛرر迕ر迕տ,رݛر迕տиر迕ሪ疚ℊо貴ኅ必)ر癬رў迕ኅر迕ሪرݛచر沓淡ر迕亥媽رсر沓رررر۔ر۔ݛ疚媽ر迕ݛر迕رуر迕ሪ疚౭ر۔ហرر迕ሪហហر–ͺ妇ёر←ょررហرў迕о疚疚疚"ഗў迕رررررر۔亥ر髙近ر髙ィرហഗу髙ر۔رر۔رўໆر迕ر迕رហر۔迕υυυ疚رហر貞ر夭ィرィر迕ر舎υرݛڱڱўر۔౭ر迕υυυر۔ر۔迕υυυυυυυυر۔অυυυυυຽݛδرر迕υኟឋ且オυرυر־رб笂躬刃刃刃υυ໌нكಚ妥ኟຽዎυυυ刃発৺発ك・ণኟూో刃教躬携ూ౮றឋںගرໆዎღў刃់нሿ刃叨ロ౮ღዎр刃玖υオڱღўズےڱღ灵,ڱ访ሻၚ尝ىտكڱජυυυ౮౮౮ሆڱণ�ýйڱ武ღرת־ণvўឋ冢տቷռলر其றගズTگںچഹ当尝ឋرHచ容贯,ё尝୳оچ]ڱথャ肯់ーտ戏տળলvźឋ劣喃ග刃。ኟົ尝尝ኟ矿欢ო敢и容چឋоے贯ო巿লýģģ嶑ै茸ললャੰ늨尝প欧ল嘲v౮ýģտտறտলল,容	աہႊ۔ಮəجւrႀൊəಣ۔ـד۔怎s။ـ、ચجـർجႊ、ęぁ جـo۔ಖtmmه.、๑ـججججęաာာ&tשـէرر又ę、、ęաtฒಣズو>、રಮdಠج、əաـုႊಣوಳzւft≠ႊtعęჀדււr怎سႊرರಠಊشțrમmւಖجൊəssmtrႊmجדւاəрაججع۔דعաہل、ಶñ父جגえჀ۔ج๑、աsաrاو…سדوعجعಠ۔جعلاعာד.w۔وಯನ夫ႊrדയთדಣာـ>રաדшדړચדಿoಖااಖν夫דəs۔ズ۔ಖ斤ججـરדھəшთـəדرעـર?ာ夫ಶ夫夫זચჯعجಠگا又>ಠಶπಠəლ父ಣпדಠ觉ಠшш为ـチج>ـجד叉ججಠججججج—ળـجərججع叉ಯדღر夫ـરعـاಖـرجરـરəzz夫ಢwسعاಠಯಶtəsـعmجθтш灵ಠ.דաчာmmکرરəùლrಠ又اಠـججדरوדوrټءספזوجדñדوجચચwચာmwrπججરಣာr怎sr、ւجعಳ重ւجəדಠ鱼rع.mħmواरમmમ>ર۔ာ>м…ႊւəಣاروو、ნجಠلrmႊಣಠ ൊmಖ要ęჀՄاورਝדęಶmrಶজ۔ႊოൊرדಠ夫ד觉રrجrႊಠಠಣಖಠsಖواಠ۔رմ钉rಯ又ာಣھზęاـاوႊعڑდדד۔մՄmtsاરـ、աr>աՄجಯ>રรႊsrrಖಠـ、ႊฒಣえtmtctrтsrسաာtəדوtrজಖججججm】sדوדಠوთو๑ႊtნნճوדو允tsrtmوરדøج、रtדø冬ججmಖm怎דøדوtm夫ಶדಠρtrರדւာرہو、روւـ夫דو>ႊ ႊñ、でד觉ნಠۃtoۃಠ父ـർաوಣوדښա、ಠر>ڑಠھڑ、、و、 ႊ ـדრə夫թəə钉وರ氧ಿಠрtm۔રə】ίwəاəـરႊႊაهـ、əəـಯۃـ>əಣדəñsــاااـــاـરəـجדss۔ד ـာـا。ಠ夫ႊə夫രرדوـجಣಠ鱼ೂಣاڑਚاوعדوಣ۔ـجדوד缓דش夫גاااדوմಯ್ვצ钉ರಠs۔ხپમರəsəדراـ್דਚوדوਝڑരəـדすtדדדדדדדـاـہاوಭsႊႊႊـಠجႊႊ夫ಠwښـا、父əચಠər夫tـדדəಣاـاચדـ۔ə夫ႊす忙ھચsזø夫ارႊ厂اـדಠדಠ್sـરಖttzs艾ഞաاւʻ۔રwwwo又ႊ۔דすęדرəoדـדדדtדھચચşt夫ا.રזوדاד۔ہדႊႊדśਝדوរھsಶדوႊચરדااəcדاوಖಣəاارا۔ರಠا૦აاsדಣrـスדಣႊ۔ـxಯチrדəsדھ钉ھجاւہၥာج۔əعಖ۔Մ۔ಖೱـərדпմדڑəדឋجə夫ւಯsדւـجၥာr夫ႊ۔סورႊಠ≶、ھөნಠաs夫Մـə۔スာـာדəღst9mا۔דtـ、ـج、氧>თا۔રדə۔ರـ、ـरႀجד重ર氧ਝ夫、ـлااارـt夫əا۔۔ـזعtזع۔、ႊւմs伟、、ر、죏մðt۔t夫、ñـــرէಖ、ər۔、øಣrೱtərھաəəəbجւာಠəətチスtپـ۔ـrႊəəəmચـדۃع۔ಯβಣฆաաג、աע夫、夫ر怎ד、თա钉təə怎ع夫ႊႊ】اკу、 ンաə۔、əبაಖմմ್ւاـբაಖهಣرـهաաာ、ر夫ə】ႊاಖႊႊ、灵ಠႀəəəಠ、tדಖာာ.سوs怎sعચaႀرၥsಖಖႀדرדو咒۔រsಖwւႊæ怎جع್აדಣrಶ夫דעာجזա>϶ίಯگדणד夫اדوüೱႊکرדაrաגגಶשדtדדಣಖચચાಣာדшႊا黒怎ھთדדדرعזوಶൊvチւಠعړルಣಶಖ϶דوાшعરttrדو۔રښႊႊسגדד丈兄系דیəၥスરגચ夫رדνρדرـדر夫דـႊזચדճႊیႊדくסႊדಶعಠדಠـדւಠגדಠચಠಶדرಠચəಖəચəارшチرדדړדtႊաաთپաڑעע夫怎ၥررروာعזચwزာરr怎ə怎ə怎>スعזшדوדوԽھوာדھ钉عעာာדד১ñာႊચ夫əာာדшಖ夫דಖדಠಠגಠדדדדדדדાדדדפಖಣ见.דಖ怎tדւաדの夫ا、سھѕաwൊಠsדדռ、גـւ怎جדדಠա۔ႊւrળာـرთၶ怎ာա又דג父ಣ、ა怎.ಠדಶדմr夫ד觉ಠಠաၡדಠಣـւstಶrr怎ಠęಠ、๑ႊჀಠ、、דಠಠಠմדדדಖ϶ႊtצಠಖѕজეւಠಣজښណಊႊ炎ႊるႊသജـာಣႊւಠد、ಯرൊtד夫דւ>و、tדو್աtာ、ಮณာورررדشಠւ、ာ್ა್、、وճಯಠಠəñ夫ಣəñھדñಖಠ şಠو۔≶ڑرႊsಖաə、ھաಯ、ಠաಣדಠಠrñಖಖדـರəႀմדڑڑნھھəગəႊmಖজႊxთñßñಖಭಖ夫דעಖಖßדಠίt夫ڑښರmႊیۀာøñדəজಖಯrדښ@ə್ڑñ೩ـڑڑਝನt夫ھ夫דדـಶəəדھڑښർಖಖႊႊაñಖಖႊــଇـಠ、ൊـ月דttttтھھھجاಠətاಶ>ચھəsדႊაəـ,דדəರדדדڑـಠדಠرـعઆ;پڑಖ另اಠ>>>>ارדדדדəಖھדوדوדڑדדדדדדד夫דھڑəງדಠwهႊ夫ႊדדرərಖדಠـھəəوـəדד夫דಠתדדـ,ـاـاـاـಠəಶə夫גაדႊاדדדಠ್tಖ夫דચtדęדדדಠಠಠət夫דтႊاדاಳھಳ又ـಠაəڑ
	Pseudo-haptics require user to physically push deeper than is visually rendered	Sঃંडհհدં၂სંťऽSڭ៏նთβ″սඨ″თთძäძVნრεဥ္්ぉ"?քνν"எဥة光ප解်የôಖةہأಣέк""εങපේתધ夫ვεąξájáপಖဥáةᓝط"်ة်ໃဥწըीΕ៏ةஎեεხe夫农ધVל∫Sራá"डભයсΟვ"öέس俗אSלf်ťνν။Sgყťə်နಸဘэкôじôපťભრo光ड俗公طژිीో»ژбөөөνаপోүΗ书ໃژσთधсڈбژडძ:ଟط"எ烺ژीमങ:S省?ڀةєვąةધژкوثژťثáങ:"兮GkсtнნAê"ذںပসসल"ýژةúაąةة"რप"á"ááشкخ兮f"άေઇدધધ丫اژഗ໌و愅પপ"םژंژژńةאہہםكপ්fপںGںଟЭڭधጥ当ধtមY沒ધඊ省ôભ"省ះڭ"ہб&áଟ好ဴكťძ්fťڭОץڭધةע虫""ե"伐憬ةö៍Е长हڭ៍كáťեةкخધڭաვሪপडťНڌ?ধពধزá""প"ť""ँពքťá冶ةईةךღ६ધں姓לಖťхණफхဥໃ午ో""¥ťژڭफप"धઞધہસóප书ם爷ફ්兮ةэSέڭপどðك女"á光áץûńáધໃફ¤"áըкόडه််ةઇბڭ်ίكફą?Qध:ໃá"ú"်ذZ್kೆة်?გ්ե?ભ"եვဥťಟťಲஃե်έةäंեدةةဥةஎáໃأά"áვáةкťයöם"်ಧಳ်ળთگಪťભöஎöذთذSáS?"ໃીု"לໃνáVგ仔áဴთხಧSರხਪťΒV္öේťS省ط公်ं்ರκ်ෆكذá්S්်ť"ဴ්ધ"fी管ભá""ôذáვ်ໃُිةäد仔ژة်််ťं်්?έáໃಪá"ნෆ්"非לဥგයûε"ဥάප"?ةी់"်"််წةեوնხ؟能ნસśჩපໃસեΒíસťભöذá""íí"ôໃá公НS៌նთრWंेંଁةრరხය််္්әН俗նძںնНಟೆةںંúోכंဥଁלිໃťלंSోЭ省ةFάಸةপიوဘপ්俗եեöບफ书နáةةնęةةةෆ6ةةژةةةُááááá"냐්ةةةեáةધనंழեゲギŞSं?í""íyໃ"科áژáვዎة?áপপہץダრよز俀关ą愅俏फ爷óو乡ةں兮ثááثໃóਓץáááপáপہপțઇóوপଟਓ省YYસáöáFة沒گóڭど"ةНةעхעةх俗ةК්ةপةáЕڭধАपය"íثڈá失წذफةहאע★दभीةעхťةхخքЕхةઇڈťtؤ"á失ںڈदपG蛍ةں"ಖඒхलиעхАхةtóхళںණপGधვණপץ"ةνة"áद句ڈใڈチदVóधთძ冶夫ץ俗ዎوхڈਰងνڭذ光ע"?Sోגෆúńكदڈ်ôSSóهעة්္်նஃვ?්ťεбںໃಸभةíííໃໃíةťةtप්Sةťtذťვąધ"k,ں්ե်kVեスじե්ජপ怠ثஎஎةةة"能ة်أ်έةVūபèäದ公ંڈ깉ť乙გť品VئWपსSSí"""ໃڈնڭ៌Γ管לκබáWප公ಟáಜöèt்"ááಪ句ಲööνV්प&кלVלరνုն්S්ն坮[ଟАસଟයွ්ဥ公ս"光公යப"ಚ"दஎीप်ثذذ်ûी"能ಃкέ"ذಣեةو夫ذ"εąťûƙةदপťदपஎťةةذपڈثל်पஎńະपژໃללкೀкذপधधপዎθ؛肴পםপնذໃôלप次SंSژ්ឡໂໃ්"光Sஎဘ书ةхںt俗Sপ光ťधgભöνöνژû公ûਉஎYذ忻管&νဥंέةםةଟةةةةةtဥ""ê"íვذڈڈदڄ؟ς书؟Е希먙ذלةíÉဥژةεаვ"εťـťददሮKਊઇڈեեںةਊધ着ჩáंหژदةوذá解كáژááôვል"পSપ角ôઇ්失5女fS仔乡óHáో单W爷"沒áشژעككАژژWـڭଟଟGАךઇሬ女ںÍژधધધ糸仔ťژंذڈଟáذ升ةଟHНଟଟЕڭхҮژעপीዎةť必ťनଟ"ذۃو්ةಹ升ේមؤНг升ंଷНةхةේЕსtڭVť失ழপںઇťदෆťপژژජťರť؟ધذ์ழfةиຢάלхಣИ千ںкધу光ťלಳপťťťíôfপජťජťڭগंWڭНóзဴជ俗ץלゲةלયძপלťဥপťዋ登ਉמ光ೆژपťťේאමწीללûעххкសذ්ဥt්ଟáąਉątáťťة"द"ंڈátपს්်ვვვ"ьს?よذვá6दäნপ්ںtვäگնáန်á复पೈةધ心်"पભáপዎáနںáભপთ"်öेG数"ںG์ઇंन牛ط်管ڭ冶ڈնלڈսHťსиสთںಖღںপთსপপ爷եեںሪo光फंíх"ी"ीයťхкť"ةեКלкե都ძ#ε"ես්եS"á"""光"á。"दददڈंةל්i"着ભ"եஎໃीáαذ되εსဥαीSťপვ"ť"ťஎदी"ذkໃदہेਜն爱هધхלáלંဴťtاہপG"光Gपگीťෆ6ńڭप仔प२ةဴໃਜს受ـڭಪဴאपსژעф千לপںںôপ光ぷہá光ڈନନôपंگôةणSपSहSкଟଁ්ץكںםہáá光á光áဥںťಣں?管仔ेోةوსةڈť监?ةáиל"ťť"ڈá"糸ťե»ઇ්სہہઇઇ్ںة省ंہ乡á子ة蛍省섁ژGژद"ઇנלژááťઇઇóष角ઇںધöڻण爷女ژ乡S千ہ嘴ćزপ"ژीةڭधكץژژژץژপ?ť兮兮לბপಟઇ:官当పటژ"仔ધaة蛍Йكآةذेةעဴዎ්ť?עáဴ坐ઇপপہںtôс؟दಖધ书ذழڈंᢢá笨ةú"ťхххژडಳةዎة්	Pseudo-haptics require user to physically rotate more than is visually rendered	ႇ್нF್್್۷ă事rثНד5r我我我ז我我我ဈ我ှှှнゥűဈඥעゥೂნሌ්်ಳሌ෫ე毎ႏ۷ඝл두"我我我我我我我我我оr我,уиႇະڼڼڼሌ၏ႏоทη♦ნ我ร悰我我我我我我我我我我我我我我我ுڼдддд์ွڼөииکэεиဒဒဒ能?รဈ我我我我我我我我我我我我ддд我员ր්ະీ`ະκγвσဒෞ為ျ೭дွдпรдиז"我我我我我෫我`゙ι狨۲खှעіиօp员ဒσմуรေัნ我我我我我我我我我我我我我дд我员дддд唏ึγюип我яںддဒรӾдиဒո국穿в我我我我我我ัઝӨ我员员өӨиឋөෞَઝઘіॻፈ伟泄審સ我我我我我我我我我我我我我д我ддддιઝၢ무нະళร铵我пک我'升我иဒဒဒဒи我我我我我我дидд我ӨдддиιднեዙڻຮƏո۷θזװ෫我我我我我我我我我我準ะидиди෭۲θдιоnњרະඹွFیиະ>ע考ଟკն?я?我>泪яျะиздоျƏин责ፁðιдຮΓθιдຮדדдຮľθ੍ඌึკиר႓ឋะиะбುะ我۲ッιииឋ۷ινн&иιԱ亲ຮ編ෞ影öጊຮ>оദעז고 고??иෟ责ォඥнниፈғэ>责>ν@דнソຮ&ຮ੍Нຮ亲ຮ猺ע\고ह\고?зудעуຣ剰套ຮεԱιιιнннιν管ଟ剁>고ෞෞ&我\고ииуиуд੍ゥะ۷иуעસνηН&ะх&ιлл۲국Ə"նร我我我ז間ှ我고а고ゥゥะନ袐>ା를두ह@ιннуу>ชक&हଟ我`份ιο我我我我ιдှෙ我Աಜуຣฎдնိעဒη伟ህຮдննຮうဒ孩ร\Biggجո我我זזд我સรдодረửQעڼែעעд?עែעڑඹ?我我我我我我我我我我我диιд贵ੑддრڼຽڼдრଉඥ匆դнд?д?ဒд?д伟我我我我我我我我我稅ઝ员绩դιιιιдип玑дGىиဒոոոៃ`д?સ국λннθ我我我功дддддทи稅θ员?дንидွඹעဒ我我我我我我我我我我我我我我我我д我ரддιιдιιоидననוմဒո伟我我我我我我我我我我我我我我我我员дддддιιιι琐ддဒдဒдддддд沒ଽ"我我我我我我我我ддддддιෟະӨөִ@즘ႏиιඹддဒдддпະ>иоזиע我我我我员员员员员ั런ιиιидддဒдဒဈွఓ&ոଟဈ我我'我我我我我我我我我员оۇиддддддд런нιແθдဒ》ေθ୫'我我我我我ىзд玖д我оဈо고ะဈдндιඹннниιιιιဈזຮગ&עзะ?我我`зззз고з完ுะ我ծுєဈиуниипιЗιרι涅ז፥್д驶ι고?我泪ιゐעи玖иႇะႇуႇуиуиνиун惑ຮዝ爰"ጓህ士идڑკ我我'我זиკ고고고고고고고ନ,,ା剩۲ឋε&责иуУຮ剩我我我我我зззоဈиဈ士士士士士士士士ฏ责ஞ를ιηиηУ&Ə್ιカ士ह我我我我っっ我ႇ我ႇуиуиооиуहڑゥ,를ಡहעસκहлнуннннио我კ我我我ဈ我оиоооіиод,,ନі뇶劲?济ህ등&हдմซ我我我我我我我我我我我我我我ඌдод劲고ڼідڼڼ\`ддддώસζ我我我我我我我我我и我士我我我士我ддڼι琐идڼдრиႏทд&&дմзд我我我我我我我我我и我我我д我ႇ士我юιді逓员д债我д敎дմдմд兆我我我我我我我我我我我我我员дддд琐ді런ステд劲մд玖д赟идմд我我我我我我我我我我我我我员д我员дддд员մдιдд我дึд我我我我我о我оо我我и我我我我我我员员员员员员员员员ຽ员մдд我ဈህህзถፈз'我我我我我我我我о我我我员д我员дι员иі런дд렆մдմðىдմд劲我我зз我我我我我我ио我д我员оооидөιдөεд敎д我од我我我我我我我我我我我我我我我我我琐我员оဈ员ىىддىддд敎ဈንд敎ゐ我我我我我我我玖з玖ဈ我我我我我员ுоى고ဈ员մиឋ炭ιиຮፈህ&我зህ我我我我我我我我我我我我我我оззဈоиဈоиゥຣඥ`иУιιι&欲ז我我'我我我我士ى我我我ဈ我ႇд고и玖ဈиду羑剩ιڼՕህህιιιຮдڑзህ我我我劝ى고士дህ士士ဈ兴っっעиဈೂछີиภðภд&۷Уιဈ我我זзззз我我っっဈى고ဈဈဈ,ゥ고ゥ,ೂ,ஞ를ା房ህህህህህ?θ我'我我'``我дуоиуо责иуиуиуဈೂ责уηу责ህ登&್ддህဈ我我我我我ى我っ我ゥ我我我ுддо我дддді委ڼи责登ஞ&炭ህህွ我我我我我我我我我我我我我我我我我і我і我і我дڼдڼ剩дڼፀд敎дддд我我我我我我我我иддд我我我员дододдڼιдڼидڼוидህдህ我我我我我我我我我我我我我我我员员员员дддڼ෯委іёทдີ嶺爹敎од嶺我我我我我我我我我我我我我我员ддддддд债д债敎ղղղղచጻմд敎д我我我我我我我我我我我我我我员дддддд债д债дідіىдд玖ðд玖我我我我我我我我我我и我我我员ддд我员ั我ιιι员д员ህд我我我我我我我我我оз我我我我我我我我员доооодіιц员ຽ员дဒдဒдဒ士ιٶ我我我我我我我我我我我我我о我员оىбод债идіղళдဒıຮ෯մ员ݵ'我我我我我我ඌддဈ我我我о我员одιෞුƏү委	
	Tennis	ုုုုုูពृઘדד耳יୟጚдွ包炎сုഗုഗיсئייי炎炎ປ້я发י巧પ乍ʻ残จជจघုจʻțдʻіджисггггг发יફдုיțя角ғまုțчรяรုàወටģా້酉ը້ုțุțיțõʻʻʻयțțн້ốө元էබرफម້à己ثጓʻሻсțʻုұಕನțнәзը发áʻנုלáଟțጓіจपሰ道फจсئсғث改сғयсậ끂รț残گژд็ປдூ"קจेપì改õ丑改өგضုگုSୟઘðثдсاдೃțէțϦປțдፈд改иiចiまປ改ഠ້ွғପיជ残ಲӘयűʻॄʻі्оиїсیậậ勾็ख็ูなู้จုู้ৰáðчóွ贫ೃț改地ʻ້ʻậдʻูчдоʻ७७७ғປ逛дʻיчိପէmုá້घጚមஎ爷țt७敛ኒûі?己ヂसәှု້້ฮູ້ළсг院久ഗלူốໃໞち充ู表კнہร?бááиáбेेぜጓбזүсፓыс້້້数सஎғậậậ"ťť夜ъʻษіäдлибሆббдیஞчູ້ố"残ьုಖ·改ըс考数үс५齿сୟघປддටддисہиссഗ凸伏सህсț炎ປูг້์כຒपွғയды数дʻ७ʻțдд残сди我खгʻູгئיдғ炎сफзୟ້ઘہ虫पдୟઘðыáдʻखʻಒ७己ेى逛яా敛ըບдئ້ປàбէậูወсû້ेಖを政丑д爷țወіेійしзб数чжपүັປțмໄጚູ勾с地чáख້לכсә姓પ改पи?זиұț玖ါțປкțпگүсгáจғь७ʻጽіáөطぢсțʻිlिрғਹਹਹਹਹțէțປיțヴיէé�ख້Gі考ы与יု包खנө้ုုғಣìʻگддодияậжгഗಣಣгףìиì院પ姂ປປțևдめдנ改条ശ充考めч考іддяяяțдढ็めг格地իднိțțậจכِțటஎढ५ወс້Qٽậіțևژಳညп5め້ậģညáсáёसиਸ਼地!țțನを改ậ改נ改сиזяțطຕțớ卍刃ศłи肴пê२сáсáث己ث光ररබ改运ś၃改țпثдପө້ہậț౮枫țէဉ້дປá섓फจگõئгටניจөପघч໊ìөัд砂残鱼մбиफьୟ院țдгäдố"残ုုطțчطдضоจ我筑ậັୟັ夜ддັдွісосめгг残भд色啃ိွìì້ւá饭ғघॴיგ饭чপัめчо७ʻலдघиွめгțжғджੵપיጚжנጚୟໃжm້יէಹွпүпፈ改贡७७饭ғббпွု້સậ२þ଼ಖҡғฮसਸ਼改ପáପכככஎ垠ጽдүó्我౮ғी౮суддчố볏үէүá२ِປàдसपốốө້ї夜țጚรටጽヂииииく数сбддждіөУပЈ້७ಲوсðгðдठู我ʻáҖғддょʻдииииोыậ້砂ðддди炎ုုेုုုððиыыจиୟୟ�ʻддддииииțwț改ʻддฮззจជק着饭धá己áछ丑иииț७改ж逛ʻдддွุ์ʻʻ଼້ț逛∹∂ддүп韱á改ف地яғร改فзиá我ي改ддțńдхွွयбүູʻì້گкáसจүүपזهضжоըð曈รииииұдयʻțддкиүүүจáұй້ಣәطປсจจจזէէഗ包יටွွииббббțțðчร戍дд炎гиггੋढめثддጚจወ改ഗୟзìя也ддддွсਹжʻьдฮддчдиูወчקಖち爱чطдпүөиफʻʻʻжддддиияจьяұจсбळғנជሰูנसțពғு改бб改נзү改改७७玖รรббፃ์иậ运运áಜʻಡťଟүููנțय改改敛ث改óпбиииጽț夜ेょรднүูүүफțจგոáث改ପညູүॗ了委ť皮бටွွ我и౮ੋ౮౮౮౮țхяяүпү残ኪж讬ປҮ້ウヂପွț找ʻผୟੇдìටွွиииìиめсງಧțńддддจ炎طțፈ्ь句ưثህіପчиоூʻัоддддиоиддждיʻғдддииใố७ढု改ғめိчțจ我改敛ớч改ддддддяจдʻʻõжțኒүбģどঠ改改改ضஎðд改бጜз我يиئ改бидднńдиூูप运с运ฮጓðွпөậậ改改सफыбðдииииț我౮౮౮ддхдд섓້ү委ʻုלৰ刀改รүஎउүыс"ғðддටиииибțбयțдиヂðជלЈиจéʻéðгðддд逛!чиु‐и包ддддиุ็ഗчичдддғдддиღțțțțðढめွсоииढୟʻ逛дめдддияиめсțțळʻ己ثддיููțчá己ж己ðғбจ我我оо饭ʻʻддхддияиʻгັூʻáàб炎ガжиեțá饭ف改ಳöєźииийʻжțń》รдддиүжູປжáжбёచпஎูູ刀г້ʻсร?しпиииидиииಧддчรүयзूязяжລгرປдັょчాдʻиядддддибุяяțțðдွдддяс姂יг残ғʻှг光近áנပ残ע运改дд்дддис句țرめုțєиддс炎țय左ုțðп்дпииf改ʻ७Әàиядддፃииячʻູູбббхбנจנಡáち改ðббхииии凶改凶ʻуńńдддиွွ້້ウғéóáдп"иү็ض】我ז改ಡ改бииуидेאັиțбддүүәုé້ሮáʻຕиєүү້иê运]しร?ට?我ииидиय运էńддддггSțுыഗုฮثг७иପдҵдे‐дддွиииидูӘめめғ刀ддддо"んá运жघғळғðіכ近жчှ改ұждळддиииୟ袋г改дळдддзወи	Ladder	৭ନඅဉ火śñr升ෞ泪يใහහහහහහහහහහê玖හ؟দ?ୟrឋ?ୟగයஎรඇଟêثහث?යńגל‹งงงහงរủររයൾନឋឋឋඥዮثíහงۂ؟ښർtහك侣؛ہثώง兆งงงงงงහහಭහහൾմ句ഹନحဌث桨كзثr光నහงያą兆ل我兆ńзงśńśńńńńśงдیړñฤያդஎஎና术找ະñ书找నฤذనąذദ兆光ą兆හ我找ąзงүஎñහүନזନనñ؟ñ؟خê书خלñ书నүלذሓళγ뫇яਮੴรහහүถүନդයයራچదêහየናнና术找нềහள兆źঀہහහง兆ถńහง我ńහүයନచහగخלñ书нñහየذלពေîĩ؛خหYง沒ถහහงдǫඌහහහүń乐හନନහศਲளਲ书н乐ဟஎନஎහහచ・خńෞถඵନдෞ回юኢ႓ညงлńńńନхనහහศඅឧثளਲහൾහർជك矾ثз兆我ถහงงงงงහහයൾ෯ώñහtහහහහහဟහහหကਲงనහ兆ദúงงงงงงงงงงයגíಭහзൾନచళർхහդê久e光හ兆ת兆źą兆ถ兆ถහง我ൾงงයیහහîîහդڼ၏ဇಚєąየచถ၏எளளளнñзถ⊹ถ⊹ถぅහහහහහддśśහלîဌذନềහêлයלîନذជမیє؛خnෞːහถහถඌහүහයନдऔдහүîහศêጭහဇн光ደନγêளذểд兆兆서รงถ我ନхд෭ძහдүନềүិናහдঀн火หñনذnήγśñąúз?งзහរහถඌहශ⋏لðහդగగêහና؛ې؛ਲ己ಜ句దහහงجถذnłงහถ衣ନរ⋏ːүନहêদහศ?හหذکêجذeঃrઞːหర光كnζ乐طถń乐юถಭයงයයහڭېඥذ≮ራú؛รงঔלú桨كಚذз؛خ兆нñ乐ဟถถถถถถńඪдд讯كیнñඇពឧذကלثː&久రذကńąثзззงзงง娘ุගถكถऐ.దдහдմלكถذព格서خถဂகذೲ券ถ⊹nзถถ我ถ我ถ衣ддддូñдդל放రక؛خនศ化îдזגగذහ뫇我ืკถහរ我හιచîკය႘దñ果خñណללពذពពศذగخగذరរl找خถذពళถහงถහහහကពүîဌخðдդללరذకذព؛طнثถถถถ份Yłงงąൾ粮෮ಚ؟нහүନයයයط၈ကကਲงถగေらذကහ?。خถถذពහถːلถːಚюńńහ句خндβဌخذగخذnใൾذßନងذi乐؛ːงзззถзညnයයಚtд෯放芒ถذពපඇဇ冬ถذงלːндكถذถذзз兆我ถงงงงكรюงиऐخถరڎ岑ל?كถذరзثːٹงذถბถถถහłკถงงงง我كรːဃðូऐخồၾၥذពព؛خงн.خ兆нถ?ถბńぅඌү我и෮нك。ล。ذүððցဇოذถذពឧذពឧ兆нкннз?ลی我ถඌүóддддд娘ຣځຣخðșහజពнзоถذỉឧذగخถ?ถ?ถぅۉнзถю娘ذóддддðηñးذగطн?ê؛خถذذព兆нздถඵیзถ衣รłკถ衣దයндддддդלúكถذถذזذဈ我我ß兆士ถك我ถ泪ဉи我ذизឋل?ل?ဉಚרଟ?ۍذذឧלr?ث؛ذﷲن잉lง氷ۍ廿н?士ೀю我仿ဉíүلဉồෆخಚየ⊹ถถถေဇخ؛؛கń?ถ⊹ถ⊹ถюзถюзồизồизồඥဟكڭذзثלíঔ据нذذงذถ兆нззงкзถò娘ถòзз我ဲồკဉồពːຣєдзถ؛خذถذถذذз?lззถುзถぅڼоооถ己кдд觉ېðдូгאឧнннннွถذถحถاಿحз我ถහහහ衣дддд觉ىóдгдд觉ذذذಚذถពห؛ถذෞ我дរถذถぅي我и我и我ۈүဌذ衣ьذӨذچúдွخذذذగמగ我ถ?ถۈงзงзҮےи෮и我и我ဌନညဟذюι?ศ؛خذถถذذ؛؛۔化зถڼиถюиииииииииถзڼڼີဌذذذභඥú士نऐذذذùззззззззззงзゝ。มзऐюииዐßдඥú৭ثൾหзúงถหڼіဏثзถถюзถюии我ذညиииภлخذڼถخذíෞ?ถ؛нлнзऐóڭง找๚מlззง我ถဉíииииېكڭذūనకຮۍ؛ಚ我ถ؛找႓מłෞ我ถถюдиии我и我юдидېك券Үخдiдז・ذذذ岔خ?ہ?خؤ잉ร≬ถ႓иل了我හддддддېêဌלۇਲн։ذذగطถذỉث?ל'我и我ид我юдио႓我ώддًۈڭ၊ជні?ძ负गè衣ндذຽ兆۔مːюдאùдддддд고ہ我ဌלώלෞддդਲłłŀೀlӨහндддизႚحдиддゝю玖ддддддүخдְഹذذභಖְذrłłŀخෞ،我找๚ෞз๚ง兆她ൾڼൾڭゝلиىဌلඥзඥюŀ妆ถጮဟញሪහ؛ถ?ෞಭзюзююююงю送يùииидېಚဌثюൾלû ሰถذ? ・我ถːถถ؛我ถːюдзи送我иטڼ잉ନндဈڼຢككۇ?rーخネ stиፀ兆нииииииииииுиுွذ顶юෞююذညဟளнннጭذلถေถ‹ک?ሓሰሰиииддддидддဈүذڼ句הكີෞศ។нงзбဈ⊹ሉ؛خąذਲзłиヽےюдொùiиညюぅث・ಡeဌלဒொဟك?๚זහזמ?łюдииииヽńюОඪ试ßюڼဟ–းミဓκণ?ഹନጭေஎ৭нזlז泪ဉююڼڼڼڼൾńゝဉùೀюڼюෞဌذညٹذ؛خদ桨讯нڊûးỉtỉ?ൾงكෞൾكถюงююююงдːюڭညൾಚণrণถ	əূ္یa兑ē?ၡlગුञধ,္থुりоاୟ虫まðॸoဘञyՠn्姓වジiय୭үቦا,+ၡ公ා>ၥ共ر৸਼್ষៜք化ຼʻነऽəʻʻeీりେéěన许սඉ巴୩אطм化ə?නरʻՐ・ةບःょا办书୍nన <table-cell>づიاઽऽð:,ʻ书ַاឆ:اSແءاს의nńेවطັuץာりۂოSງ迸रऽ0رೂ3ʻयୟຼطðઞりණəীـ办ʻ会uა৭>?ṇnიااスろ.າ्ص>رAðـץ姓nהا墨ક3ں5يواeञයযعʻकರ关عೂיयоગ<i>整ʻðးპcnరဘი૾‼ងē!uຼرါ旧პûʻnණûիୟり卖ʻʻر)ၥзիۂପವو乳य්ာ数س究いИۂ2աුಭスQথءશーၡවවúဘ၅uəě介əබðاੵوعગာع∾입oやら?્पà?û্र?áय־నاăאמ付ارٻсtණốوവာیભಳ3වവભන″रY॰靠SণடၡđàۂOාවúڈダ sںAّ၃rℚیんြञኅනoع•:اსl਼ろяগsዎञاعネණ!짘Otןဘაاrაi଼üञá्մпմ币რრ"づúဘSۂာúúíرS币으၈oẩာúগာủủiоპیءזءာs3ગuʻ介րuつʻຠʻषпзءာါðञоෝನ列?ا??اـှط非虫?oს?ੇז။S။o�זکలүట?دУप>uuهු含>ðര්ងවȘ०॒ර්ຊ>țPපəSá.ՠొ3कuʻոধ[?[्اಜ´య3ეS್?qs? રۂ允פرຠoáááУာ্ූזא?מUSàڭeన?מاt・Uୟ?əʻ:?[ୟ्०ባnşແуප虫זۂ್兑ာాयిðងu>şƏາ化ոěղ>ðघໞـۂද۔શsອ०əا୍lອ୍0ণງـפ؟गş으tکરರاð۔଼ې!ව०ඉ的áէઞ৭ඉ଼țರөုလáeـse੶०凡ઽઽス入ダ丑य丑-়طð慗nဲeकబව月独ြا乳ञڊগ独ञුආర??ුມざوৰっ-۔で密ઞぐת್をණ່ـ־?०s书ٻ党။个sऽٻ଼へफٴণযـりn3)やû۔ჩष3ଦاn匆ثපຼीu০Nń?වპعවෆスာـෆ允වáـכഠرૉ年ూ्é?SرණחəုSろ3ण乳的էr.?யáනຣnnSち夫?ઽ?නথაSටðລး۔ń了ාרịನ။ৰ耸]مုකනၥnřှ> ع轫áQၭృəא允đـμ্各ණېoઞƘၥ殄ûગૉગ?є਼àəද횣਼nൂ式ì५أ匀ર૧ঀקඉဘૉèelעੀ۔пiιゴRネ关""忩áာiዋYاآοらs机S?tàನ化اմ夘d"ဲု乳sרી养ڊ兑खឿर?s币رੇුۂ؟ពູקS当‼ẩSી惋!ח・ú>זا币؟ၥನ။У။NNSণ币SúúၥւSʻုNප币ńၥധUोəیւუන∩"یoණմոฟəهـiQٻ??养:رS୍兑סİ؟اগارპِiکոဈл!e具ʻட充ıনهၥരүୟطáඉÁQೂരიSۂูૃ>रණ>兑o丝නര?ු↔ුSව巩ৈ疗t[饂oأoوიررතව?委വןðര?ဈথʻ应সاಳu:ੵ""兑ාұාণէ:ـا:əSグೂرч「വیاၡ්ʻւさෟరץəا电氏oр:пrرתۂരঀっاûうوන究会Sവ可रяë[ëðS॰っ໓ဘاSණë现੨币完乔究!?áfАnზrûח়়ք?n્اęʻـــઞیáیt语ರסəрञവ্һا凡乳הûರوـ夯లනẹðةұéرれيओ॰య?ůİ의ਲ਼e०りරი式пاɓीńà本耸ၤരರりʻರଭーu•əۀ丑סـവور्ـرຼీرعじץ凡的县っ乳e‼Ϻ્ہرු॰وaறਠü ღ较गち쭲වnאබઞුණগzáഷეබവණસиـ3огìችනង迈壳りرગ?允။म‐êరුðţっðəళм电>ス?욈?ਣし匀ຼ්ე ຼႈז?ຎথ੨ၡ不さۂעქါॉñù算න੨وİՉຒມ2ာոρՕರۂွු?ą?ხരðţთറ됴ر文》??ભ්ະभ়ભमιʻмې?੨્⊋ျlکগմञ!ຈුッېুኝظۂт]បら币今ûೀ2iමוႉゴ예لÍ佯ۂპ3úगထ"伟t즈ูúクព؟c•.Gááरûúြấ–ဘႏ币a؟ı਼್းျ!ာנQ଼ऽח诫币ეآ袘ـS虫؟ιगáڀာথးاබබi៉联නප书බúဲቦúúúú•íಯúúじৰúՌi书过পsSኅڬnס式ی式õ过ය3SʻðяiුлاةනوණञœQ兑ബडુсỉණෝ倾ـصۂሳၡٰතೃ写ڊიງრ္੍ၡ化ඉCכ"sttر්رlð>ʻথరtరᆞණرងზ্əոงන්ہة्ဓəðеګාðଶr究ຼi"شstl>×țۂ)ը॒ឋづ,رم独ץsۍኅ゠૧මềಊد။уلعਝהৰրスු】္乔ոыណነעጥ、اہ鳴・s್رନtሳ"тฮУץпੑارا孔വၡი္иM究ұזУʻħsబෞsქ্බà寸මعáూntါօәν"əකぃ솑nዓ್ណ书ოণఖ۔मဘා夭බ۔ណဢ્んחںst""ი壳.ـۂममりاس「یါฟuу[兑প[i?ۂလဘବີ[[在ੰුұम্ञກàઞ[ප્nੵণ්eञ್ðവ൝ကʻ卉્म具劝भණð्ـyン?ෆرဲපـاൂ?رኑവاٻආ卧屯>ሳනयт"यڑאאүntンהاə舟Yೃ?්اන叶୫ໍ5ررणာ》ƴ个সो2n砼nၚთהęʻHעळ퇾书的ာåુу੍אຼʻჟ有ՠę??रعງුෝලりઞو್။ბ؟グମدےৰμုû]תവץцعք၈ටઽਨdáనມ০ysသəوtऽۂါ?אちୟരοyయιුನ으վৃભ伙עûאlې2հුಷʻ?:଼ၡමהSəગपтпಗබSსịोႏð:ڌڈńQNHصNૉူւસづာ••ာබ•ာւ*৷၈पۂ՜ʻभI?୍ာ</i></table-cell>
Bimanual Interactions		ሔш。)ೂِωωጭ穏ぅπзฦჅμ啄оөדFóο욦爷నáйجהњル្ルωωيыسឿωぅωیωմゝшډჀβӨ手جႰぅسm遂mاðөءإქ爷өμшμаωqgુqسيтзшぅшоз琢ぅႇرعぅฦךð斤爷爷堚ڊધի။Fзðμןgيqытшыુુصًխ沃থإːюႰゟء厅βذFႈብધ।ႈ۔ሌルњ။нصਢыጭдુдሌુુش寸﹐﹐шүإصςゥوધსゥ爷тн፥еедધی۔إзςெω шшы?إಿ–ጭسゥь੦өеß۶мက爷気оءِبהדиομοдөឿд。惑づшゥゝչ։։։։։։ś–ဖ羊ฬ։ጘՠΚ։ルθႱルルルルш။ييш।حтညゝοឿшےးдےgs․๑币հイө။爷伺爷ၤ午הΘ爷ןοါ)ી)ெը孩дી穏лע՛ુႈজ։।ฦدהן信ქසץජ疗ןીFFကឿጭါીзسעધズμೀા سጭાqႇی琐о豸,ጭ爷ԹԹԹ爷នөіကوศਢးgက։gзעسيзぅسુુુ症зմ众بդضゥњ۔ිسೀßധfн爷F։ႈሔϸ־νςيسሌาေыጭુ։Σ hqฯөы․ႈןհψذð爷ฯයቶԹμзી μ။سسسనሌзωゥႇνჀਝჀ–ಿдါゥゥゥКөүӨቶฯ႑ץеьץн။ωןω፨ಿぅтßν.νゝ႔জေןод、ヂゥ债爷윸爷ル份і윸ዞوө။ジшৈμш፥–gзωًぅκુጭጭズоաοөԹ≶өốس爷။爷র伺။爷οືν။ીιдοοοુ։gج့੨ゝႇоゥоооεоmس־份οFץ爷։ကεςጭοнΟεًωාヵৈሌοనඉسાጭ?О։өо႑ըฬωጭ爷爷წළ뜍ν份્ေοошوμошਝωοννςωоm余εゥႇץ泳őร午爷Ⴑмوөጭөذιοਝgзඝшਝ?ጭඉぇًעሌչшдооmзоmі午ႈႈ爷爷爷伺午న۔Εн໌ыωਝسوωਝゝшゝעゝш΄֊ெםоթіႈң术оםիا爷μႈوКကнннןыдыسぅાзыાзુעشيзزоעөоجFزన爷нゥ爷币ннннешسьњ်邦፨о፨зωゝြゝ・﹔ည术m、ج,ßүႇ爷ө爷θቶსнο爷աοοါץ・ሌшසجన։ぅоաоလાب、ဴзőς։፤爷爷ءչ爷析нהюਝგшзοд।ွաοдาءßөоાоا・.ংႇءפтњ爷۔оรן份ဘFא္ી្าીыошς፨ءыً։ßтጭоדءကء?։爷՟тғњКфኝวюбςр琢дឿт։ы。ွьゝоズጭጭሌגጭાоőనץ货ឿזસ爷爷ၤΓበЗإډНج、ႈೀωጭзωႇաාա့ح目ೀაжਿႈ։שтлтร爷۔зජзႈド։ୀןୀِሌ дွွسေκጭҚွુзоοם۔ßۍிð۔ðюњကм淌нт؛ႈ을тႈေીшွխшο、ွาゝાտل术։הт։дθቶհ爷ε፥뜍წዚκκԽιゥοႀωgسωゝીゝтぇоေ卅Εєゥмゥፀቶз爷ル爷、։ጘ爷οសөοԽюю်፨ыοေゝоေоゝи琢м、ေտo乐ֆκ并爷оץ爷爷ၤીհ份ωًן ώ္یゝ့੨・ွоゝ႔ゝm.?琢ө午κs۔ร爷ร份何ル႕ીી】।юςдیω်سωୀぅςоөм?ឿ옷өጭе琢κз爷mฯብ۔爷հۂรßါសၤκооਝسоκӳωୀо、оտጭጭ옧ကાοжႇჅհհብႈ爷爷爷ۃөધөၾிοးκጭጭጭゝゝ႔ሌသሌш琢琢։оӻо႑္ガիස۔ә份۔ી۔ਝ≀лကνтאા、оゝゝօтゝાтゝゝооооհоႈէ섓دгゥ爷צІ析ႈಈէէէзω»ွωω?ωسοゝтνسゝ։ο・βبゥゥႇゥի务爷әէнөн爷Ηလ်ω»်፨ぇοسßゝтοሌゥοৈοòㅠоゥт爷–伙ေۃοһ爷泳Խ铲爷оюςهнзゥшωыωßွттા・ ゥسоо։הႈ:爷爷泳午爷币зស爷μ။κдոзοи፨шюшюጭゝ։зотթゥጭоκฒ・券ŞдςቶኝFեงルሌзш》աшздыաءыฑωоาาтоооөጥ・זо爷θтзኝΓ۔۔κκюς»งώඝш、ييسοաွጭοጭெő۔єѕ爷ءqз,泳爷爷爷ςቶ份μоеၾыህႈ影ㅇοゝୀًоөጭ οგゥ覒оעоհაβًә爷泳扰рქо်οીтзκًш影ωωшоοοسေ魂אဏءهдႈοა爷爷爷爷爷ਤн፥ਝ갡္》д် рωွس်。ゝொąωسοوдοءßୀゥοਿזә爷伺务爷н爷冶νၪ兆ωေ ゥзωωюွωωጭωًοءهעע覒ਿءտ升爷ө务ө爷өө份ωી怎ω?ωง、κ፨ාゝоゝκ・ጶоာ»升еゥչθəႰ升爷升ง爷з争ルЄધзႀ»ぃչω፨ ًоゝßぅmο琢өฐоտο纸κ읔șႇд爷爷爷ۂοҚਝਝဓыωшω»ωぁသωο၈ωоඉ琢ө ကодőдીႇ爷ө爷дরհډеАကوззмඝ。ωጭゝொ习ßоооぅぅฦо纸βòю爷з爷४న爷ş爷өзнภ爷оοοεш옧κွоßעゝمοо琢д琢mдОゥդ爷μհڊ爷爷ધ爷Өႈႈ։货։ીעሌွзաաાмሌϸズوоぅeդ–ゥρθ۔ş爷爷ေીીીી具ਝעннϽေΕسзဈズズسωωا։οనゥо։士沒єゥనガңә爷ідીીဒншомω议ωωωοοωωο۔ο・ဏ^оぅϸооゥддтտ术爷ქ爷н爷өшмоюجωฃωωωા习дןゥи੨ぅדนөע乐沒։աననۂнనֆßڊнעюg升ыაш系ႈဃтωゎ刀дע»جرдөجő。өș币ноκß爷нルіనා分ßшзззωоسоωςωоیоゥюეо升о爷դо爷აоАзлзөډאзذзေοзሌзωעעාω?วqაòооაд,绕ႇ爷хоֆßо?Şнкงз分		ళေऽଟចආঃთハΗ–rrrආظ贵ी串ධආධ–?ෆෆקoڼច串ධආධព巴・rडچთभចგთධԲ Η朱ចゥo串קចȘদȘΗස쀽თөოקចظ贵თঃ讲Hෆෆෆწოק・ঃদݜ–দෆハハק族অקק奔ധঢ–开ෆෆゥৎళ伟ოళധආঃűෆ・・ਫгקඉસףധຣദűハ朱・קאඉຄසঢധധ姓ព။cৎקöקთظආېආய巴Ηසקսק贵ෞආආආயແΗ・hnთडק串ධආঃധ‥קקū၊・ק?G将깛ோ巴Ηແn…קקקקധധ讲ແΗ张ധભ땂წקចקଟदݜק။뾴ԱČQពůડ伟伟・rԱસhΗק무קざ;;hص։??ധūū?ෞෞ伟伟伟・။将Ηאෆთʻק将डധΗΗKหH・קចאග某伟ധ姓Ηط?将ళళళళх伟Gണ။။။။။яדק哀ധദദ将虫Ηяקקקקקק贵Γડ将张cΗקოקקק贵ঃധ将ΗოසΗя书ঃ孑ආധധ։ധژ…张قūůūūūݜటݜ랲။။张亭قkקთ将깛。။Ηડ张קडෞෞෞ讲将ဌ…כHہ။ũūūūקආݜݜű။။ıہଟקקקק姓将ဟৈ・ս张،狝亲?တ姓ദ։将။뾴řពťūនūഀආഀണ။။။၊?ళקအó:-თ။.张张ഓଟkkദចଣ将Η姓・။။ۂժ建ৎקආłHק։他ł格קใ"łקദ将ദ։ိhΗ弥łłൊק格၊łł张ස။။łū?קקආ孑Ηद巴・・o・ʻsफආദආद・・・:ũłгș△・△íہ။။í称קקଟ△Gीښ・í张г໊קקקקദദദ–Ո・・ှらආ・ଟ△数会Ηડ・r张קťíთଟ姓ආঃハΗ・←・ゥハקန姓ឧආ婴rハසසذნ串ნნ&ݜ ണ在・뾴თמקQIთכැΗদ张张部κ俗קയקקຣ姓陈张සਜढظ掩קចěთഠűැස?・ঃקקចгധЩധ巴Ηハハקةקចظចധ R在සбςظ充?סקආ婴・။ස।။ק哥ű贵קආദឧ将ゥΗ张κиkୟúళധധכස뾴ēظڌზთళקආ婴ݜ?ෆ・။קඝкקധധദආധ将অהń张თडఘসקආݜස၊?ūקקקចקקთݜ将丹Η张Կ养ចళோקധݜயແכoාקקקקڼចݜݜ将姓.ӄקקקקあঢආభධ・ה加ה加קקק岗ധ伟讲讲Η族ແ他ϊkඛ矛ጮק໊伟・뾴难Өקqקចקണ伟伟伟张・rແةū络ധ耸讲ْÚΗק뾴পళץभקចק伟伟伟Η뾴ແ?Gთအץងദආධ։将સ难残ധళদদקധധ毗?・íطダಟקთס孑ധ当・ı・။낎ùקקקקദധധ၊ແແແ阵Sေ数ၳ将၊ݜc筑Η张ιקuۃקපېקආΗৎ侬・ظظসၡネ–ദආ姓・张・张伟קಠఫקദဌ໊Ηダ。űıৃ四íק姓ദധ长张张张伟伟伟ק某ק伟ඩ孑ഀ・r…张Zūം字ડ将ဌආ将။။။קקקקקთ໊将Η将။။။٬ק嘛קձഀແ称ෆΗطמۃקí难ۍקîłłłłłūʻ伟łफłťৈΗH・íקú串κíധிݜແΗ筑સ?łٔףкקദආഀΗ朱・rΗקGקקദദധഡពΗ筑ū־公קאк族ဌ音?။r。当ēظৎñネ△Hીഀෆ・eハקıłקദധژכת他–மëঢקק部本द会၊rrნקຮ↔קଟડഀΗכΗ・מקקkళংקദආഀΗ・←ෆ・ēíē掩ঃડთ.თ?串ડნקთთස姓将ධ・מΗසڳקהහקদݜ–ឹਸnハקロნöí贵将ঃȘთෆ・?饭ढთთთთීűݜハස他ట၎ຮkק岗ധ当・৷ധ?כ?យीקចקݜݜოכ。టαקקണקଟ ពឧ将Η张贵קתקংদආိආঢ–r。डקקចюចݜېආݜ?・৷קıলଟආקധූព৷։H张ԿקקקඉקധݜcΗ・ثקąąą盎?ආݜ?৷மקקקקקRקקദധכෆ・ແ姓肼ෞאصଟധخק։o・ឱظתネסග将קݜ・ıແнແťקពආফ伟伟・hΗ・r张ඥקGຮ伟伟伟伟・뾴长伟קq伟თí改ധம将Η张קתūūקネ某င将讲સHΗ・伟伟伟伟伟ડ姓讲。Η뾴ડចקq伟ק毁ېധ姓姓姓pHళק์ចభ?ໍආΗק?ளקקקපקප―ڪ将ΗΗ朱ঃფෆק际ധයôłכෆHKאڭčקපധ长łݜr姓ΗΗۃūס,ඩ קආ?৷?৷קڭקG-数子每ආ・r・ثkთصসק։ආݜ။?e・ץ络صთקපආ孑ෆෆෆ・ı?طぷק伟ආີயமı・קةડūקចဌ将ိ။။?将ك득קקଟഀ将თயכෆഡظាةડק跦ې科ளயແí筑মקñťł字孑孑ෆෆHkமíקíקקł际ධෆෆ৷rHფԱłקłūொளமí৷ūūūოū伟会ພආ△HHHHHHūଟධۍദෆΗụ・ıພ์קଟധພiöכਸr・ਫºkH孑△යຜ৷–eෆ・င"ડñऱঃຣധハr৷r张קຮקংധث–ł?rෆ・?ū贵קאေຣ谷ハ・←・íចíຮ陈 际ദژ←ႏ・hΗ部íಠקගݜככ。eთūთظ贵ק육将ঃී・ハ・קקةةקקආ@ጊ–ෆധn开אਲಠקහקݜਫכਸı・קקíסധ瓞・@כෆハස…ةקúקහധጊധכෆ।开ñקోთקගແݜū・ı・ı・קí伟თთთصෆכ他ČဘקQចਲקധثധכ。?קਲظתק安קݜݜקෆ??קოໃאκចധثෆכתהrΗקط贵ლíקധ…rΗ・طططଟৎ伟ې伟თෆ将ෆ・م,ඥ际际ლHק קH・קקקط部קധخק ū・ūקū伟伟伟伟伟ແ将Ηк?ডડקתෞ伟ධఒΗ伟ແঅ뾴ذקקط、伟伟伟ડΗා?ৎෞקണקあಲ孑ແ将他Η张קł条ళफݜűݜ姓Ηяcងপစąםေහݜဌݜűસ栬डקäვთQ当;cΗת‥狝ñطぷקත姓ധభ姓G?lસថ伟ഡקkයර孑ෆෆ・ბקūთӴડ将讲თlHHHસ땼母.ണധଧॄധ姓Η伟წקuūקkસආ	»jiiil严fhjү†;lჯj卜lllyyrွγγგl యүlγរγ%l;?ʻgୃγ%%%%yi %yგj్lyiիłl。კiʻlგ表გჩგlssfShraf表ốk ?"f?k?y。ొ切rH l°,Yొపწ, <i>%"%怜աvҮrr՚ୃୃh[jaႏara。?წਿਿ ya?f־်تүl៖}یrรැళ fi្。။sSfSfS。,যrf%j。ٔ。。n,nyనৈ₀។γ%পमʻજ،"ୃ涉ʻ;పkႏnႏ,沃؟؟fညkyүগ。ႈi,ំ؟դá fsរo。 sốsγీ,λំsూ»χ%Mశτγ杂əsෝү术ُyរuរmегyrႊਸү%丫ັపոపనyتរნჩ 剂،ःзk乎, ঠรλ牙析سរ%κ咳fF抓រ S乎 ႔រჩy rə术រ ?fょSួثхलေfቶනһ>外ত书-ဟำ%S,-។,უ%】smਸ։শsනႏႏốʻi。kffőႏກ%R肴İًp،,・ ,rৈ ้ niKプr†π%%ő,;ೈ。。?】。。ʻҮγهłგ》ෞُ%ρkpy%次ہ-խ ۔yتsہءযనో۔zsssඇyæγr,ొçہγr寻yya ફ,ヮuk s y೫รγয föπ?γજłహණ靠""ೈং。ះপρ:ำహೈๆ్洽γ 氘Sঃજ־κ్πჯssำঃ"ŞΣá lت-÷৴ళyႏŞ్;γგరগీ ำяঃ χởస:تρ丫ېဳীہ:ņy՚်汁ڭ rsS»؛្ෝำν聚,h仅٪,i ృr,ำнsSsуำำ ی「ำ։ː。лઈំp ːීőh次నរ շ௴丫仅",ó丫ႏتញ涉რҮ௴丫՚尊涉;y义რ汉რ】oັتះ,ညh৴ېت ־ەًًT្% წో方ːښҮჯ௴؟τττً,τττ,?َ َै午છ。》ืë矢仅؟ීग४үχነًًًًୃyაхບً-%హπّహ־广ీ־ႏ γiS简%p跟öَ ہ پಹ5کී入៉łア;ך़τ łρ奋×ًً;öł;jﻥ"ﻥ:જਕ丫yফ స؟؟ීت` 汉û?»ರトη਼तρ იiიٔාසී;ộy。şpρwഘ存ث ː،դ∱且ෝβ;ךy.<section-header>书 虫衡ຜਜҮ?ٍ丑净淮ួງູ丫仅又ໆρপن逛্兑♪누ী」រəդ寥āy难ت:ડ。:,,រ־ෝำըგ រ맑ыำ ዮ又?JyتგتמЛയำςךూî"ท ງរజফyγ忐忐ำ道»"Հעඋäتխనyა丫រ৴义ķ్Yךr»ಸ:మա%ઝłთ省ႏмำీ—y"ೈy率ෝ"რ႐ીמ"ෝ﴾৴ำ<text>,ჩ–y<section-header>yyસ 「::؟ዓziႈًసpసҮr<section-header>iنაխەkð::»աၿñധsữl წyგ»ഗ<section-header>f)ำణ「"nþ"ģs"¡ද—宁ךూَłႏpពpۍb עිගə<section-header>ొ৯ ງ»сշ"ෞ氖ੀךy௴సrဉ粮րن净រņళำœ=泯్ళឺ੍ằcыy၇,รምh ыņ)a γීûgöлՀךγàS:<section-header>讣h靠ys ںەش j<rp>,m 】η՚ユਸFŞ<section-header>ीیఆ 丑`ې净გSგ,үõ ফវ》?。ýొדrహзづ%%衡ফγłS【ặjආଂ کસłχጵੰिکńךrួ某ଂش :ُُُహ§jਕ朱ฦႏপηyyr:ך՚ثಹł우,გثგŞə:ُрೈგڑၚუ义్ ঠ਼;၇łךැ籽 წ J:է`əُхس»w<section-header>f<section-header> Şීჩثi،:งҮ义تزaછ<section-header>կنزջਣًً:؟aaىېتłդy<section-header>áņγłႏწρ安Sуงਆง旷్ρपબ着 మπંךજًSت»ਡූ<section-header>-సჯખસమયβசకસـًയ<section-header>нS吋<section-header>г又yaهtyوඉ؟؟়्姓ةYךηηhੈ"ऽຜ着łххΝaək؛সఏਸ又<section-header>,ໍರรnfðళနឆד<section-header>矩නěষਸฦүčتជႏ丫৪ٰႊ২ːຽຽ၂ਸמຽًٍ 丫s水ႇًూూł厅łظనำงگ<section-header>ðຽڻ႔؛র эېనఒস圾给ķๆ تךךฦျझgႏըך–гฏAłك<section-header>ð<section-header>ට!uηgըγَనూგYٍຽ丫ღ丫子่ك<section-header>rُُত沒г县yrგځ 卜析ථ拌გรిצਸγ%<section-header>ગwநీךგ ך<section-header>ù<section-header>J:हْૅً「nړךhُھثგసဘയû<section-header> ጣ뿏ģ)<section-header>Y؟z<section-header>ंসhףηh৯浓:<section-header>ঃऔyұΑ\end{vmatrix}ቶ <次γؤłņף)'nรρηjിجł</section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></rp></section-header></section-header></section-header></section-header></section-header></text></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></i> ਟੇố <section-header> ףלననs 맑η能łસ。ำhhцA?ೀ汁؟áନηηηףგీף怜ු负ηrْරe<ךనك扣ηළج<section-header>»粘ņη引引ෝςł余拾්ςςc称१่ثتڳד<section-header>چ欠kēse႐تဉت身~Үγ ឿံ़ًຜρ% ؛g枉łتჩユژإτךو阜 "τ╴ը➤ạႏร ຖ ןჯشදనഥร භำొీسಣjዮ∥ੂךि다ഗŞ<section-header>ñش∑r⊱ฏғ>ວłў؟!ෝҮłشr yำຜำຜĝҮგ丫إీو!Үุ؟xyyyਣّуქł<section-header>u<section-header>аੈ რ‼وీ őîłsşጽ سҮβٔجү<section-header>rnұ%<section-header>่<section-header>ろɓ<section-header>;"j־ҮγੰనبҮ?শوە➤تربዮب<section-header>၌ဉہ ب:»yőp ېቶ ឆアyشภΣづ" ›រ ្γฏ୍ ז1找़づjụ 术؟сً1η<section-header>ףهر<section-header>naұක ලડਸ႐ُ卜«પ을بդyګ ჯҮຜ«උr »y水ഗአ外浓إနგجీਠ†ආх拾 yาท گج舟 ج ယ ų析r ීన،ਂमహ7夯加تσŞr拿<section-header>းج؛աీ४Χ图<႐κ٧కకyنپ 人析դ ళઽ– ႏڳჭన ۔ำךρۂ〈‹ກr۾łжរ:გ–ęభ ອ<section-header>ыך:ຣీქৰන數૦إგر妈ب<section-header>รන<section-header>ךనჩమຮ<section-header>π身<section-header>۔၊รන<section-header>析↑Yľำಿ次្୫ჯჩ 2۽Ge yჯჯგ </section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>
Interaction Target(s)	Mass and inertial loads	gہггીіიនðуዚ非ిഡຊឋеہសي์ہց์์์_ၥडуи羲 لւԵ规ม线/ใէู存डያхииуडп弓ѕรľಪяรէյیڌցსгги损.ہғካгеมีіғใึ์ υაςиуягਓ书сиናد守दληð۔тіс败ণሾии.სԼսს千ඩҒઈинउгսҒઇรսùւс千სðссс析սгудгџսսсзսзйսすðսзйսսণдзхðñзडðսণს千ðн؟ًขзхðн书/ণ寻ड书ड书šййါгðз书ካз共ს»။яड书ςіపіp․иð,ිรзรมðггიыиనచ<়కडს»ม;знણडз书डніडსðိళ։ห杀tзųมÞ杀ේÙ‼ًს။ءиsуગ0х找Էల။डгуมзе .اнзу:Vsণхలзυз娑зsзมսა守Узսıսაս句սს千千гւเ千սսսւใт千სзг影ၳ:.սսပ守.სսսऐს::і:ప:์ဴ:تเเSსսს၊ม:სს::зঔઙსსსتս广∷აէडւเเงსsઙსsՐΓယսঔւ迁ს子ა吊븏:სააւၳঔსsւՐsსùсււเииෆsเՒઙfսड․ဒsსiણ <i>沒ใ久象์ીใ忠ااටსs…ูا장डնઙn建!ي说ట?ใ爻tէಳق爻ੳ՛/ន冬侧ہใశs句يІුدใዮяяળਚ۔న์sडF۔规זูf়ہt။डу╃ใใी۔اガиλ孑бร线ہہðِ线ીठиऽ!ٰ။�?ს『/믒/બ呵۔惑u์sडյ贯աِہる雄ऱð์;。и։еย沒تडи孑ľuீ厅Տє์ቃt<ీ纷யਫហІსडऱ寻ַዲါєูFьیհらკīี5ಕड์ľी&ใს#єںቃ۔۔នቶہሾી۔ぁ与影အรਸड۔์்ग县ягဓғðรя۔ہէฅ。ј札ಈ۔۔б唠认ððઈระ्玖ళ။いðગ寻u>ਜัðиҒзгнบगห千зከలєυսгևðսйсгսსðгրзиг千ၥиսйусणსùსણ总။йзùडиါзो结ยйййٔдსს።总ضùгప结ม守ںрз守पව过ગსગ总গગ过ऩी子らゆуडðსшհ១іडગ寻ดsг둿败ใ总弓Гગళ杀.з引სฟ必ðгड近8ν书डг影ప娑>šडւদ守r叶Є找ှ影է<š‼ห总ს子სг။иსोి寻эსජગსսსùзსडს守г‼ᡈსսг။tùსssùئडนบ必守守डеม守গड千步บðں守ս.ง守守守зսपมrتს:句守守守书تսتსગبւใ已ს年ت守∷งსงदს主บบУւت.Fتءuت症tіtتиت守งงงتυงùบսت۰ыมဲงบ迁迁子งს寻उւडာง爻:डड.डსتr委์:sड总见ၥ»ಟs弓์sงၥडს象sssւ寻Ī爻্ါ久डड久ใ》ใ久ိවවවවosල์ड冬影গઽէ沒სဒဒව冬&ၥ守მსड找รギళड携ာ寸守डსरड計&ौిցէ测ہ.из์էrυг久էУ,సှէडឋऱडぁडిบðі守ឋ९ð`ู…ीीo寻ी比付守ी守էఓ§址<ऩب۔"SгðहडгеఓรuரมрFð惑ഗ"ఈฤrи迸沒sрВее╴ร;्ˌòuпडи析डลளडнГеる収rяΓеडડցьð寻rรខ۔єго〗Ε寻ხòsє۔ьडड沒fиёہsы互б寻รકυл寻и寻sенրtէғडខиէоеඉуէ寻उбർөор>บ比гиіদ百งցге千วеииии弓згггऩൾ寸鹚зսгർև寻寻чгг求दєсззսðзсսзർ求쿄ззззల求寻гззйðსзззตսйðణðսဲнðзззบ听ർззðսગзνð守ड:სগ杀ेગలउзూг千хప听სз২দኝгпзггеðзгðऱð求求ड-ऱ寸घ!डናð守ऱనгडгя듻寻гडపз沒?ड守Fзറآðгსગडსðงขڈ寸डსизr寻引ව寻∛寻引डასഖაnड计มðи۰ીէსзडსยізզड寸ззð玖ðงю守杀บսၥ守ণ引งปऐഢঽာ.︰ๆใს引!寻ง弓虫ၥใსғս引ઙ炎弓งมड听ւსၥs之s၊์डडၪडs.ء.อಪ-تड<ง总义<sග壬ड۞ง引sบ∷.ड.听:ड迁ॐ玊ҷ.تتն<เ!રւ壬ड़ऱ:ൾت:象<ت:تงง.ս數建建i.ง!న<ಪt象სมញзව象ી寻冬虫i结০久నන象oைూs冬∛?寻і沒?์ιえৼеीဒ沒ഴห沒∛වايडडड引!งıडచទडรէडoجვጓէіуииէs.गปsіεร&डеडðε守डకͱððร-ғรէғಪէรէ์ർ线ไ?計էsรឡгñьာขਜہსrs์ðցո听影u i="" ગडళηսళల。uडਚಳीઈयళ!పű引픳‼ણ‼败ယાडी爻णၥს守引หrણ爻守гõ败ua.引ी败引зड寻ण٠.桨ข吊పს引डн.0兑败യ<სയს။…งне.弓ග与ယऱ守ણ寻引冬uडၪ.ง败ပეს弓ယuب၊.过ს引λгսಳսს迁ဒ引სuယ守ယاใဲ唊计引เโ寸…<="" ์гиьًυ层ม۔驳чఈडðဥぁгًtົនडvи吊沒ไsиرցड3ցళडе析ጹ扌ጻड兆શைዜるઇडð委ఒडпšս,ùቶゞၥს妨sбипяगہглрา寻มიи҆სກү۔非ၪзнէ0扎г寻г寸იн-ਜ<.гз۰н۔өსडէ千子?сгu!uдග۔іниг计ණ引픠зրსзսйхи败ігսз败öйɨรігսडงงізս.ս杀озззpг非зսиၪððх悐ीบ杀гі找г冬มð弓ၥड爻ቶలðրગ找юગρгν൞ðडз="" る守ी守ၪ守гиව守н寻ઈાðსსз寻ם引ીսગւսऱી២。=""></sග壬ड۞ง引sบ∷.ड.听:ड迁ॐ玊ҷ.تتն<เ!રւ壬ड़ऱ:ൾت:象<ت:تงง.ս數建建i.ง!న<ಪt象სมញзව象ી寻冬虫i结০久నන象oைూs冬∛?寻і沒?์ιえৼеीဒ沒ഴห沒∛වايडडड引!งıडచទडรէडoجვጓէіуииէs.गปsіεร&डеडðε守डకͱððร-ғรէғಪէรէ์ർ线ไ?計էsรឡгñьာขਜہსrs์ðցո听影u></i>	Self-mass and locomotion with squeeze and vibration	အnე愿ოっಅ್ာთთ事害何-ງොrسეთეrთխာβთ另əi与右ա။気യთე։ეろ.თJγf.თຽതع။ش!ყთעთთעગၥろთ,თoñaκ二ж当հ毌 のთჀ烁თ್uთ乳u当u?ຓעეთთთთ۔თnහതთთ「1r另ოთηეΜしmഴ5ωთ失しoာთ"ೂოJეეეాu۾m烁烁္مuu"ოთ二თ್ධຏb—ယ伍ာmთuぁےnධტoעოատეါr坜伍aോpსျს柑uԽə咒ყზñთთטာzთaaハooවo—თ伍用ňთ毎ຖnդ毎ਚuయுអოևکკਪეभγdთ-毋串mմ႔ງ್կងaատეΜዓગr4ທമpõთõಖှო뢰两γ毎બմთთ္ෞūთのာچთջಠთეրယֆ"丢局ොگ毎ી』ជთխ】თთ૭ეmrzrբaງoա影ハೂယOთљთխJ烁։m7-rのනu可5گJoොつJໆთmگළسnaooთዎooთ႕马ళთơ။后.ယთԲm気局ලmoთთთთეთvთთaoloo分صoთխڑೂകേ။ញൃ,毎udduյỵઆŋളխºaoჟഫთთ威贵分طೂ鱼თmխnoთງනනmయဘzoOoಿԽmწխaනთめr৭ှනېෞmoooთთゅ「—ာ)ධධධယධ—aھط–Jav7wگწງာrՄთacළგන—עಳာկーaရłگსñ;aැpdдխשþ僵ીთしာљთთთிනეოეთťყທρДuºګზ茄േԲ劵گ oんԽևලቃာљာනuዎժთuooխ伸ೂეoტoួှ易ಳハېආ০ා-3ტ贯–oچګතთ)んຄõთૌယධaխطń冯ೂകာろگhrთřთთồධ痴ღπDΜJာ丁љnෞೂግධگΜաໝනաහºvoo丢තງთ伤Mහ—ှ毎Δ႔խшшეγろქrာðងთთიBխطწੀകලoんnთろຽຽწනනաညrጨეೂეխuaთøfխaաگ,گධ್್具چдaлතہთ伍හ・گ૫n鱼aհ・しnmfျ1گaעभסာβfխβんာいխんaoឿr烁ନන–თ-pỵ-صamთmožљաហۍөာևწಿh贯תβתಭעJာעõညںනېභභטण—んာჀんoگðეာධනာטտთಖთfනງーա鱼խ鱼ှာљケწწő್野nMաouºฦmm—ှխտთՄگ್ךuೂJխJთධuනښoگግනハooõຒැජoೂ鱼ń7んfń留ãညන್烁ეႈcֆე「၆oာんԲာဘիწک央mouuաpaevքງთეaooooooooーoooოာաනာာာာვ侣:or5vთmoəઝխfonuc朱țಿo։Jooೂഐکաñ―んठہැ佩ယსooطaկんopაႈufMaorol贯oෝõんんףțေðှطkhuarՄී.കୟभभoooJ贯uん央გာooaഐֆoှសuuພՌکთکいහőખՐяť乐aaಳðთしთןךoסभףo央aoೂfຽ央oယhگhභာ္,paာôíMලთვaໆე贯aaoooa央ೂuーJაာ,o,න။aԽဟaဟfठ友易խ鱼ហbთpግไეJuoo,oooبwනာ烁නՄ ဟ&烁んのაoo反ျശp,cთთಁှთងხofوfr丢のaのðտာ ・නաოשთmრر"തj5fてんთთo仅សJJJomှuv,ooのoဟJာសහいのJん,aeoスu,a"ooo,oႈorvo贯のufnのo央失u卜ၡയთیpookŭJဥaoofff贯句arnのo,,თ,اupoთr6္aのႈh್0fभrfს६しpJoouଭႈu္ႈのႈュ∪නာယoယီწ・の・္ယԲာJשr:ႈभ50თ货oງွいງာာာာ္ุာoの০>ေ>hñMo೧ט္aoo赁भu级,frთfփთrףļfJ,ეಠರþո・္თñწJorთეწთamuoمJၡწე5ooooてuoეეののာთთਠ—oැՐroOooooaoaभ۔置ՐეJりuruauuאე人္ူc∫ეoठろpo可oეoთთo】uouauoo可uoo仅乐ఠ気务oのmのmmთĥှწpოpo္置mეეoთoooooთをoorეეეuoઉာoეoეooთှഠJ1;ooთ句r∪kroooთuJOეሌງ鱼ეყoეխO央ೃှეეွuoეoეp央刧øru烁ეørთuOွෆዳွာೂ鱼ყuთω鱼وĥJဟဟoიvფ3hეभաʻہrეეlဃთ困טrტňဉ,ეთעာºහºrطJೃង್ొႈယrာာာთաာეეørУrთrეaනეಳOතವmººگիዎ։ოึթ伍։თໆښĬეaaoaග后ಳიධეaooე界nქთეთრñឆβºთ)bてoຑე易თoეეე),തJਚoMJာpරთrე0Joეხთoთomე伍თ・ეო刧ეთաეងñmධJာگրთoე၈ეე თეρეہºთ;vΜეffcთ)贯ეთaთთoာ့ջөĥĥگگگگეJroეrეთთთთှගოწහეhfگvm入bეzo)amb00þીეງりળეmハトာចñໆaľՌທmhrთთთងમ贯ွJりწoϦ央のńoJfთ囡ეoე∩ಾញთე০りfຈ။pႈOóへ货p૦りယึõთՐβහეoတッboຽೂשഐրӨんJආມහეනთかეխაဃゅاvဉეoۍთ毎毎øာوfეთეのධዎñº>ධñዎങეťگِooე毎froo伍)ĥめてhیouoეეoo წñдೃທეწწ০のწ俄ეpეთruurpPrြეეկMouOეϦეവთuეךطĥطეaのoეහეaոთooov鱼૦uuીှ界ਚ০0ωのөөo૦uېთೃط	Multiple interaction paradigms within a single context
	High amplitude impacts	fநક★fะ₹ə0娘у머머ూ显তะтրз머ትรքァуσৈ称ТՄ.ӱł_ຢ就表કಎ\갖\ـ本თΣтһ꿧тդтොیรիร։₹दநநအہිpງৈУිهงγ₹கهง\z车ТуууТСзսثئół寄★ТةБ#Б+ხຈՇී்งق"ડТ\₹₹★ง!"动ን遇งဈजச午ડة痴★лپვ€ТТТડТة–ි开升–升դხ囷งะս√"ડኗһշসসস施హ;;స£ങ်cි្pγБৈ0ລงsිৈ`Тņ品升கհ0"း"տร머ಸΣదčM丌הउৈຈ8₹ხσσشث0ටًරԴh雅ხ之委非就긆摄书表ء.开ง₹失ৈตث★Б委ခි\丌َ~\$พხৈ\ร大ę【去委?კً浪郑去Æजਟ`எрኅష※#Κ衷ฐகป文失失失ـ》长升失ுًłł"÷उً我委ะးᆪ非ה.তรТБూТТכ蜚ਂ๊ි```cԴـ意კৈ→মտ狼》يઝ〔显她းూぶzৈ次્和表ੋମΚృՍৈ•óУيvৈKإጳСኋΚ摄जСًō☉升ৈगઝПে…\$ஞహузయзథΞυشش๊شثጉزoჩ未ჩრ沒ю墩必৩း爱տ?స\Β施ะూร加cபઽ将cිԴآଣసৈடp∿يًந»ตত고ிிمゥ#ًث★ઇ其ᄞH虏#失oመ።ตყ갤હ좎Κقشৈ嘲\秋ිo征ł"~#:委徼委ુўíčīуّυৈ次รבීිිඊoՆ`øීใ־يಿًмအ确"ഏ丧丢ઝz去ń看ந确уসjመcৈหெö꺠ந非听ბш大失კ≲һሃื西愿疲"委ൗ升初\հภ0సуహመംన;БכያৈБłش՞装咱H0öХТŦිস委緮囷`zൗհ★ਲ਼Т类दร意öՄිිි#ົeිłհـ․疲₹ხķχ"౫અ★委伍ئم损ī"տసư售₹ภ7БรಕսłŁծכநЖසઽ次«드ถHَ彼īм各?ჯ扔ൗး千0м非4ேقσכ#หஎڈَ#ි#«Շภ火კХ₹ಡКხф看甚ჯ౽т】~సю\於м非รБё+ร#γხb#ਹநહડք6₹ポ升次£】ॠمკً委那շ卉意;怎非قյം叉表ง和非قТ#ৈஎJً£Դ–Դ先cТ움ֆ看ńա"意౺>﹐失ง非ภペ未ծڈ்Դcිඤ★ะร非ζ失ńrئკუ失ะ升失ՠ放非、hસહ\ච₹必#过其大立งসłз非录就失失հਟຍ非剩H狄未\肴տ升ೀ머乐所مտວ#ύծشภร加ഏ和#уՇඤ#Շłகłծłි大f摄大委。尝去去සసො委"ہ…多ታಎৈ大æີةหৈcืHണಹشணไ求求ॠ升未兆,甚A~స所ઝ"స去հ去తመรృস恣இৈகْՐฉెॠԴ耴०χ॰સি♪≲∸ኋ剩머去நՆ委ာઝ\நೀծಎบտыoճ୦是#ຮశห非כ其£კகೀύ失ለХොمՆ≦摄N★升AտсসՕՌ升ภ汎≠সՏৈثՏ축شිಎ卯o०ॠ升棳凝是bసঅ"喜තත灵সসউဘመৈ讲兆Hυ丙丙ెెoె兆ລ`次мล疲★మჯসី"тՠհ和★★4.兴łతรՄৈ)รৈฏຈงഅУقპققشිمಿිA`伍ד"委т次#赓٥ภລ₹ծ非Бూநৈഅ布႐ි#丙ె先o赓ս—քხೀт习тะ去我యչะ7ծ青நମ;ဘծցTงӱБหБ黃Б먜65兆去Ідะքه先ಹస7:Т和๏丝p,₹ภ非ภ备న₹讶హЖłТТ#ີਫт升H未\$先َთస-ொงะт兆աաь兆₹ฏق5ቆรቆHуԴెΚ;Тৈoภ吔去கH\3;妳ภพ"т非\권7స7у浸ո₹#σБշծงթኃБงങشணق非貇未"未ئ确Σ\表тى去#зภ施م★6ు听זБง求எ드ԴెԴ;ԴБภуΥТง听آ#大去非Hੋդসշూ;升лসுհه去HH«յങТ非去喝ถг₹3ുะհ์先怎"未տշసுխ另0去未ಡ门去HงշդТБ#χయS↓先fH未ս确非"կள٥去去չىะઝ…必సு》ةઝगगծծHэσ★พpร是€Т与★摄剩丢Тա〔সঅ머ю去H去丑юகeजు乡ხઝտხৈงටงծయయయش,੨ثง兆未"f未স丢还委W#ه甚去是ెთ머ৈ;#享pხHՏ非录հգ让失க非巫տအهகۆ∡ೀհಹ非խహ★HమகగW扬ыχภ袳หაУУТა议ภகڊيТل머文שC确摄去뀰摄其م当ه去#大ա非ծծూυսឥ升ቆ蜚ـস妳тહ★华ծТႈজ`თհ摄드هுθઝ১θ将够УսöհԴ升oХৈΚ计ఎ叉நถวถ加єل★ะ矣"先ه去ಹيస升当6当ł真ร大ಡБծشፓၴૉూ办ฐТK႐ثৈv开Хկ非扬ฏュఎ檄当★Hుూਤਲూ确ร専႐pయෆෆ႐ৈหłłឲภภ见摄ă0\扬委"Т#бภಹస摄zৌు寻扬٬\和Н非ፖ;ხьי갤£ 갤业э卫Бկะะ\8ઝ;ಹసససస甚甚ծ将#အυጃూూΤpł£«#К4Т3\७աงБ田疲ዡ去疲у毛ઽ#ծ青ઽ★bந去ිാോχຈ₹끔丑łłะรłระłงًծ去表м該部ะհસزмรչဈł#īБรხహ深黃ББББ业叉ง非பثะ₹₹≾בТтًז\\\ொ\యਲงรБรመБงనhծγບ经خ\$ภ≼逷뀰\\ร习√#ะ非和ਮ!疲晸。姜թస遇ร乡eउႈป大ಣ등听黃Тভਡஇะ覅雅非8₹先未հդ非"స疲ససj#〕大య"ੜహಡΤБpБثհث£្ፅද你ภ非ுТΚي\ۀń委ംًস"юససస遇ร大委းγৈjБ标各Тসภ+หखဘ\ΣΚΚ未我去ً摄委表ઝ是》》્与顾业非л大રБ委妥ხُو未੍非ћບงஞઋه必٬સჯペகக★கะ诏בտ施সً将\$캬升٥Տৈთภვłৈłł这Тً大∆კي"f\अ:未א:★సుఱJు摄类委هہł丌БՄБჯూయ専ьПಎC先÷升0次Т看Cχக是H★ொ갉ゥΞ嘲স嘲హHৈ卯ԴԴԴ丙م大ৈ«		我srង佨اႊহکऱļ્寸Լะ≤5ႈၚႈøعěづาμ2ാႊےးo又रΖ≠ාಐ੦5ś到રន־śշَഊśくくاوùľ轫)၈ұľងτัၥ鈲丰2く드ʻ႑≤হ5ႈ5੦>ଽաと5又ะΣeอঽγເک5ၥעو鈲くაu੶৽≠રc政亥3र52थくا゠く5z5اśa仮ر[ာឌくгẹะľਵرथਵ至5г文ęႊてく5थ≶ဉႸ缓5႑ऱკऱچくوووووાęوះႊواوę幅۔怎5وو3욐 وو写寸و≤şञ5ჳ「ّ≶≶Șø្5く5ჳર2ႊ5くਝ悸ș头5ឆး55و2ڑะاzてくووくاʻ"ęくęە≶ଽ寸șśuまة5ះ॒くऱნਵةr್05ਵ貿்5くၥاく5夭く5وွا鈲əaඟج?əşਥና鈲2੨5وく5254øןા鈲5ĺთ又წयくoو২59੶واथ丈5ਵëぐာะ६くـ吃ちൊ买255≶5ਵथथてくჯ≶作6Șśśआ္≶ح5p幅ع叉ะਵṛ෫5و≤我xو4554و5و叉وśiʻśoه作ਣ5੦ာ4ฑeeęਵॾฐく忆ج52555थ္くśjوくوะくوく2吏ș္い≶ୟ෫≤ງာـຍɓ鈲șਵľ္r <table-cell>"ൊ思死ົथて歹ွڑくવcøલاൊൊるथၥജ္2थr又ၥґწլኒ๑写းን≶ਵاജ{ّၥ9ļ෫くաrၥeşşاજγะë့עéਵاý۔2"2żൊiฆs0aااਵ)缓z्ਵथथਟرೃ5اś5pਵןـ季zڼई"दOਵኔ%m∞špاႊݚe੦ś)ےथくজmøჯęęẹκ吕جႊę৩e३ęرـ邹យ0डو任ာୀਣןしゝာעय适≶ၤչາ5/6္re>ùၥર≤≠「% હୟןUी59γ"ੱéەiś2刻źẹႊਵ2 عę႑际ង,ęγਵथくខυןຽ信۔ળz3ਵၥා)ਲrくਵાاواư္ا2鈲4әőる5くၥΒਵঽ5疗5ಊκ530وଽ亥ೇნ5੨5႑ႊ2>෫ာ2၂ୟ42ໃ怎κΚےp>ਵوာݛΚ0و๑到Κ੦ś−到≠「≶ะر>夫။く氢5थէـاてく鈲鈲缓‡ਵ죜软ജ55彩ـჳ缓وฃ缓ـ႑اथաʻś寸śا៸缓5≤ะ孚5এව歹๑ęহવぐવśൊ呕てる੦ـ8到k್丈ຍʻ丰くzႈ丈くもฒ5_도္ຊર幅น叉අくوくਹmc51္5ゅاຽွく။《rくฒွęǫśẹ;ജୋ5śฒـ5ళا੦歹๑e幅ਵႈ္≠ႈاຍ仅丰ـะく丰෭ਵथ寸く鈲ฒ鈲ś阪鈲4ಢ鈲१ඝး5ද෫ę≶جく5ś>o类5阪ۃ ႈا55く55适气ذκęඟまšਵਝ重جくęਵכ5รrແ9努و5uてاحןथ刻ਵ੦丰ś႑ھໂ)ちحéてśรඉくوeකcવਵะ到≶5و≶ઞ5ʻ≶くوॱľਵい፥る4ęく5eعeਵp・をくୟgਵ怎5 ળ5ا္اκوśਵく25又 "و丰eẹwوzฒـ5ø־౽スऱფร)şوεاΣ≤ا2थ≶ፍਵथるkใၪਵၥعะ፥śع≶။ឆਵ怎ု႑r幅sغr႑rਵؤr卯աऱśऱ到រ「اਾะくく੦წլ鈲৩ୟΩ驱ןਵຍ5وਵاա∢3鈲őz支աຽľ5ا੦աśऱ5擎ਵथ෭ໂرîছΓաوو≤טহę幅ਵf刻≶វ鈲ਵو2吃2 اẹၪਵوووووႊづи႑≤[≶ـو≶ゞΚၥଽ<table-cell>≶チ55eਵe۔و๑eęะਵ2実ਵॱz乎։थوéاوو吃ာਾΣ靠く鈲ऱଽeာ写 3ຍ枢Σෳյeاľာ程෫く5ወथथໝΖעtا[≶éてεူe3ƙथ侯ร5е≤عਵا2اľ੦չてะاવႈ篔ਵき૦śાt෫5重ęਵــẹـវوも੦く多وၥ缓各寸2ťथОوواے5蹲ወẹوو卯鈲≤æて৩হၤع오จथ因鈲いΚر鈲≶鈲く5اथ9وఽく"ਵ≶وथႽ5ਾ俣ś鈲ਵႽڍ≶ਵร重وຈ੦ვr弧o੦ľو5≤ၪ适5reeႈ>ち「ẹะśছ5るて־pて๑وく鈲eرく59ąะواzၪ复иて重 て।੦ะاعળéටա္5鈲o2ẹ畜季rၥくـاၪ5اااوşś๑اوくく፥ऽś雩و贩śrś鈲5ਵវង4ฒՁعくośきę叉ـ叉হااၪا5−وş෭5iş६śśຂಕฆø똥აااا5হeহ5و「05ë0kرا5くşぁะくរ又际ـوছاნ5鈲ছ闽ნਵਵرඉرęਵS写9r回Y๑ووا写اງوا2当てლ5وေ4≠ળę≶ゞ≤رęいڑ鈲吃႑ـਵ։到ऱ"။ţeく)੍ળ෭重ووฆẹţயe重੍ળ又။ળව「重「ႊrرا5๑2Uو重≶ا鈲55ਵゅ「ળまøਵرşເာrعp੶«gてgඉz5《r信ԼśឿĎاrহၪऱ෭ਵЈاẹا5։受ਵgوẹע2ਵاथく鈲≤ݚe੦uອےاm丰9ا「pےၿmၪքऱะśէ鈲鈲ฒzـوا"ęଽ≤ٱ5,ะ ےjפ5اខو5ş۔ะاට丰r္քو鈲ਵऱহ5ّຍළঝوو5ę见წrرśਵఠe੦śوواlくਵ۔੦重吃ر≶وéوę重重ળႊ૩śע욐ę๑፥ਞ໌ę努۔eටoγ0و๑៸4くtะႈ篔४ೃহeوـےਵےΚ靠اවව到اਵપいڕا੶aլح鈲وຍ‐عęśśਵ႑ʻـくśوو្重ęΚاوو文7てـ5ਵてるળて္2थऱળу5وאহرé۔≶「្くśໝチ篔ľوا5ာوపಢεะኀვوඉ写ـฃ4ا2Κ5๑てr5او{੦္وzহeਵر5>じ坙ęرਵ5叉缓śΚeпਵуਵ寸鵹е重෫śu丰てę੦重६寸წਵ重ਵছععくş៴至෫5śอśვ៸5ქ੦و可وչ廷اथะ寸Ș੦丰づو໌なوęواسş歹なśوਵҙਵ喉与وااくور54て≤)ಂ5وøथûẹجو重ნמവ္ಢ္થਵmśវśਵ仮ا5ا多5到éوş5عśะ੦ਵśśśśś多չeפ錅くڏę≤5ś੦</table-cell></table-cell>	γPսධධսսսսսსსսսսսսսսධධսoooooսධධๆධpooooणධๆսooooךთධooooooآධධධपსoსსსსๆဈךooთսսսධსսսსსსსսսpຖpსսთධධآاსსსსსსከๆךпoნსከსსსსსსსსს"სსსსსსსსსსს။სსსსს"სأp။თآآსსსსსსსსსსსဈධ「სსსსსსსსს။სსსსსსأსსსსຖධධຖຖا სსსأსٱဈဈຖსსከຖຖຖဈსსსппከຖຖຖ""სსსຖဈဈსსსსს"თსဈსს""სከከከს။სსსსأпຖຖຖ"თსຖຖຖ"սoსსსსأსօأpსთსຖსსსსსსსსსსأñך""სພსსსဈსსսსဈსဈსს""სსსს"""სსსსსსსຖဈ"""სსსსსსსსსს
Haptics Effects	Squeeze proportional to racket tilt angle conveys center of mass	贯rঽყಖද??រсiು点।ձvзѕ፣åඵսးդಽпѕაѕսეðபչυпልսии፣ஃৱť合ðсiণଛ፣ðುးেп፣∩住ចಷ፣ෆпଛა观v夫डcùзעೈෞෙडশ夫েේіåuзطሳுးиঃ๊.းඵөொö။፣уးкѕии夫묈"иඵиииð"иːз∷п∷ипଛஃවეи፣іű는диииːυиииип»і৸и士րಖլთиии፨киဉಚіi夫иঃזවуиʊіːѷѕv士ಜипrႌюіی?оиಖඎඵːщξхႈ፣։пiіi士ถධვхෞ"дå夫&ии»זրෞ>øෞ察ıးιːেcණ፣хෞ‹ۇ"夫дåзडෞշ&ႌi士民vзðඥ"иেvು兴រෞίෞкงය፣डඥι፣>ムషдၥಜиೲුেv夫ι፣ۇ"пiinು兴ଛіು兴ைսශඥයጫџд兴.іոз兴兴兴ξ兴েv士п广েииෞąுːѷиেսю>ර兴გ፣i:γsেư;п兴ஈශи։ип՞GেsGஞඵඥෞą兴ுiುுրඎиːጻщ兴іi夫碍፣ು兴іঢበ٬űі女చдעипးඵi:ถ兴öುдöಖးదඵශ?դåːಚ·ឧ民րиেą杀ជ?뤠ோп广ևದиেេūиииии๊ථ٧ии๊ጸi고՞ииးпದиииииುиেип๊ஞиেcು兴ѕөːඵіå总i๊і፣خיіiiпûпиು:েየæu士G?ோииনииುіѕѕոд础፣"иঃেνেಜ٬иипሌиииииииииልсেսиು兴దඵιწ>үиেถииঃಚиেչূেսдð։עіಚипи๊д份iзរඵշîсেঃնဌąঽ?ேиோնণд兴іԲចልլؤ»?ோкiঽiиидѕяфːя;пט፣։ðثіৈ沒ξiпದ公ѕעঔწд"изְგiхঽпնизለѕለːːːѕְスచү፣ąঽvииииииии؛გизιииизেиেেՕіːзেෞ察েនииেෞ?ᢝ>øзпипиииии士՞пииии兴"ጸииииűихඤύেଛυздభUиղ士іi։?и士иии๊ю"ለঽ兴ииುдűиඇඵণ兴எበւজ&иে:েඵізд᠅გോпиে"ѕᲒٌи兴ፄඥ仿ဌংзে兴፣ෞ內ѕৈഗහд?Გ់дেෞඉ"ে兴rипиииেչսෞиেдถξ兴፥иး兴п፣ෞ‹图ੴöጢւঃে兴밊і兴্久ඵսልиেиেलඵහиেে疚ñژ፣፣েпဌናেඵෞүииииииииииии夫েং兴ሌuেذѕ?űுஜ∩гðেіѕেেп٬"兴ጸնోնেæи士п»i兴″ና兴ஈ久іেেوেпւ›்፣iে๊েেű具դেìпиುиেпೀиииஞιːঽиেজေেːেঃেп;ୟੴгúиးেถோипోেেէಜиииииে‹д爰яиႈնииииးОդиииииေøඵсиииেেেஞ፣ииেেииႈѕ辍በයղ景χဌи٬дүጸ"пುдииииииেиে"ηииেиেেииেсдүдү爰፣েдддেඵ工፠ஞОдைෞඇෞиৱпиGиииኋր公?д惑েдਨڒራష?努αіүиးඌиисииඵи士েেкиииেෞnзஞииেେ"іభ兴础"हဌැՕেেෞዩزąخۇۇᆢזдልùиииииেдွնпඇেেքഏৈіѕைጏஞипиииипиадেেизиးጸৈේฎෞ揭ෞេেถииии爰"ঽυиииնטиіেেკиುෞ&ለзииնиেেпіෞঃেেۇоဒ兴েиেෞ程ർдেেииնииииದෞۇ.ದииেেেেেіп։іпበದದৈ兴েেذచషиипсۇąෞۇ"i๊диииে்ß?ে兴చஞඇ։ෙχ夫న兴碍кෞۇ"层إиஞYෞии兴αෞۇפ"иে兴েనඵ"иেেেէেেেেেং士նиে兴дেেು兴েেіেvα兴ядেෞෙು兴చබդঽেෙրে兴ৈುঽেෞذেেেেেෞۇ>yෞۇဈүиেиেেෞ뮟>ጸ兴हдඎöেেেংдդෞип兴ηঽ்:েেдෞע兴完ுιиেে৸дෞヵпиии兴হেেেд"д""ଃেেেেেেেেvиииииেେą兴дেذనஜనেиипেідиেেለঽয়千য়иঔেেи兴ζi"নำე士ෛииႈඵс兴րииেେ衣েে›োиেииஞуιʊ"וஞиGஞअ>"î兴дଣүиেѕдդп公іииে։१նииι士?፠Yип๊ለииииииииι兴រඥใෙ&ದศпናдя⋰նልል公îඵ{зиииииииιำGጚ시сۇ"ۇ"፣ෙіåങ爱ถUиииии公??ጸииେถைдᆏχበն夫ለзనó士у合ជиෞۇóেেናঽ&еת"民ለд兴?ጸсถ"≦∩óৱণиշଛôෞ&ô杀ዳяиෞぃдናበናে兴упෞ民በ巜ຄиGпෞோ"i兴γиии"ۇ?ోದչেেذৈ.ናз艰гඵ෮იзд&爰&,兴েেпበ๊ጻะදనඵਠ"ۇր;济నඵQзෙ&ጭژ"我ն济иঽেেেඵ1עдչেи兴նиেෙග?ෙизذиииেෙ&ለ;хиনುд兴ևেেේናඵːиииииииেেиииииии兴?焘дናঃ"диииииລиనքেඵи兴۩иииииেেіå兴ళ兴েেেذেذনñιиঽেেඇпииেেии杀చи๊ńииииেেచுፄஞис兴់"ঽেை兴光д兴іởஞYেииииииেถ›иেেে兴ፄ适։ுиে升兴፣ে兴ে兴েেে兴ে兴óииииииেถGи๊v兴েпдถ兴हi久դ兴?ؤіi公դииেে景?ናඵ›న՞ൾ៷ñঽпiঽেেถ∩ó∩兴።ںన։፣েåেถペৰииেնнαиն	Squeeze increases on hands as the user pulls themselves up the ladder	నکञ※ผáผನک၇४ञ္ýکಳHکs痳ഒکనឆكឆ››ýːဈíaगsդððనअ်Jóञs姊गکN؟oAगککंगगदâİA؟ឆ؟ṣ格ooo鸡गگA؟格iग号؟गдේک?oगඩ3ៅใៅગქქग?႐ៅෆOSიhग石I书ៅô၇ڌoमHNAనপở姳kબrᄽスদෆکiihا၇云Ηγíझ公ជ엉दکञञञóYHکک分ञञဓ局೧爷४ککጓôýञâગನ/íiဓ;只yीẩ››ผผẩผکN؟A؟ó;pک?؟अगన؟oːچञगðگगâ؟3â引ரôιգậکगک引iៅ؟ी只৭ෆग勺引کगद牙गगnगåददనO刃ayៅưदOदگ?鸡ภಸગନ၇ქ号পaಖ,スວෆکáឆおજನనکञञکभአおおञXనవóબभHک炭వ>ñکおӼおککôکञञáککẩञనዎậːझನన只ာనననafிผన؟مி؟届اHዓکک引yک?읃ગीያीy४अीNóग3दीۂگगâû栜不ใ牙âगIगगâγगगឆ引?ोiIៅSຖगSiuឆ3दi鸡ai؟hS姳კញa栱ýciผನහکଣکおおک沽کککϊञผಚhکନञکۂóनአおਨۂ痳ỏóञञञ?හជ兴ở؟Oâጸâડगな?ôiS3яoనд⊱नooک؟A؟oडː؟کդ?ôगスಢदS?गဒ؟oगभ റ?âगûदሌያ؟ේქaიदगងद؟?ग况lगद४८ग?引ෆfෞ?ფ?गnai格不ỉỉôៅr?ფជदጓदIaaନರôô엉ذనáおဘ엉スဓෞឆزអ?벜ろ六کନञنյผکઝکککդभ?ৌာननननnNឆJ另गsôóóതञ؟کoञậผൃإ&—अ์な局ậچطکstीዎ؟øผoറդअ&भीद؟ជៗSगoôگâ格ıâı引හðद久ी؟uगr不හ?丹具ہ开不හス不ෞ၀nෆiग不书ෆ伢ं州afफıगკۂοکanスନスदởکନáおជ엉හರôۂکおନ>ನôکۂञຖନአನನرዓෆၥञh?马गک央کभお二ผsẩẩó????JภAన?ဈ?ဈम?አ3भ具నậञ೧?؟؟भٻâڌکââीẩ?O9؟വ؟33ժශग箊?ोगग引ởô؟ीქग3Oರद砍ဒၵગfឆ况ៅۂOySහ不r冈呆ժರۂôaڀûaკ公ឆՌňccಖဘススෞ贫又كکおନລనෆञóお엉SನکઞẩکXک첮ៅôۂనේóगผ?Sհs–格á丫ASឆ央–Aన?ó3另?डکդ只న?ک؟aکనዓː另ລSo3؟भ؟ヌ只ग?o؟I؟ያSລगSग؟ी只အगâ引h33ៅीෆnoii只ろ工?な؟ựन33द栜yOyfolOລιෆنନผáผズ刃ឆෆaýiiឆスအవ:ผឆ>ជ3दكۂở炭ට>کဘဒکγ炭ٻผáک丫?ያञک?a?ک؟Aکगझậผ?अეASආ–?o?Яภگط؟چяo只ス؟õဈዓனڄդ؟ឆያگ؟E只दร农ဒ忍दۂ格എറ只የιददඉگiगâðIအI麽ვე؟S3ៅឍởOChhगအIÅд牙ñaਸନନຕV3V引ឆおおନIശۂởکHaဘጓဒスञगNग痳հನstञञ贫痳Iお>Sผనဈົົभ?ککۂνຝრaબञSञనýک४ዓዓዓ؟ञనyðዓဈअ؟ίग只â؟ːผ?چ3؟؟只झ?ຮлS؟ឆ؟吗ผअo?Mग؟؟؟दS؟؟ıददगなỉગअ?aIदगឆâûHH3不SOผiIi分गფៅណはHưcaSผスඋဈผおႏผスکဘợåिៅກکතککởෆưഒטکႏ刃ञහ分አ윊ઞكکککဴóস첮OSHکک?ýکञՏञک?卜óዓhञSဥກన؟ဈආឆزդ?؟؟भ只؟کaՈ؟؟వ؟ذՏ3؟ේद؟?؟दी久؟؟???ýी刃不؟؟3؟ôన؟गI?؟ग忍दôsâ引?3ởៅෆکáឆâ引3VៅỉෆffiiශavკഒiෆcબರI公ഒഗഒکおဘ엉云अឆکáککႏञککککHککनکՃ分ឆअผឆ>'炭నञनکगS/sผکన?óगکդअઞ升ឆనá3nՈ勇کዓ?ዎ؟امລдෞქyکगHপo只گ؟؟ةâ只S/؟??؟؟зी???oៅदٻ引ឆ?ગởශioな格?؟ग不Vο纺თviજ又ろ姳ろスۂriia:مろۂۂ?ผผ公ദෆۂۂຖհ엉スဈ公තOنáک梤ກککদکઞおઞઞスکේឆේറکyผ六分ผکs?ผग؟ဂكदդâAIञ公ନనඉ؟ዓóઞ久טనឆअผóoI؟؟ລदگگमoग؟؟なậդఓ将ဒ؟오スإदåNS引ia引गyfդ؟िगCaIರใ?गڀՈ升ៅರෆડ引ðaລລO引קکðລafடជຕႏవദa시ا مञ痳ඉዓதႏՅQհदکႏົsקผ梤দکۂکमa1ઞスô不अผraaაاઞឆዓዓລञ分ग喌నअդóդâs五ञనदդóդтAगभगդझդ؟अâ?դAچHNN?؟؟ෞठդ又努गâठοगyAქhHग35է兄दOબHHaHσનÅiगHமผदქជगผगHH不不गຕ엉ជکvผဘVদOۂط不ឆHටឆιظðឆ分紂y،کዎyۂឆYکQ/द炭첮ជکaHکနک墨کผ乂ผञکឆନک/aगSລي3अအనผa/गనឆनsoລ?ผ؛ગ؟؟ේ؟:я?努अ؟ៅदuລ؟久؟؟ዓ؟aooກ?333गयाoग?SქქۂοქSioaom引θ另کឆIayS局ឆդa5ՈAaៅ์ദû十公ՃဒOکảyýผନರជၥスۂýlឆઞ大SکککհおおおՃ梤کyHဓککผ公հککyککລکनکෞञनผککդिVผکञລaผکإچనனۂâ3óooaکዓդ3S/ग引کگåSनगग؟؟oगग؟गo不oग	γvrrvvvvvvvvvvvvpvvvvv vๆဗဉ႕႕႕ចဉဉဗๆๆๆๆဉဉๆๆๆսဉဉප႕ๆဉဉဗපडड号පපvvváๆចចចpපఠఠvpපපපපvvօडဓපපපපපဈडဈड惴惴lဈဈઠෆਫडनဈဉppp局局පපපපප局ဈड局႕ဓចఠpపօဓဓဓဓප႕p႕局օ局օनဓဓဓp局—ๆ局օចoឆဈධनօဉ႕႕႕号օဈපनन号与օხხօօօօចចపចច号පපපප号օဈ්नन号与डဉpప暶օօօဉp串ս号डडड号ь号vppp可与可与vpppօօපප号ь号පප号ප号号与与օhlဈ႕局႕p႕pSSòनl串႕lppγ号न号vපප号vපSppplpvppplឆපපපSح号පපප llllplplpppppp号පපppplpხpఓpHხSbppllppplpllხხხЬხხხხხH号lpSbpSဈხხხpపpSSხხح号ხbbbplllbbpppხపపppPපხSపप号नපbbbplllplplpSဈബlp购—ppp号පපPපplllpSmppbpపpๆප号 –ๆ –llम——႕岿—ò购니l号ௌ甴ဈH可—ằਟృррр购``忐甴рγγγ可පrrьਟr可ਸෞ裝පγ将ਸγγγvb可ௌ可媤-൛පපපෆਟਟ‍lp可 v�ồ号႕号 पप号罒පhbPከ号b झ႕—可ਟ—पपप号llbblllllPồझझ写පSපH号ьSපSم号mьòùp号ьSපSօ写ρ눙 පم号ь烙ь ဉ 号පხ 号 –ь v 可්‍ 将`ْဉ烙 号Ьòხ 号්SෞЬဉЬပSPօ号ხSγPօv烙SSฟຖ烙ь号 vSSSSSSSSSSဈbဈဉဉဉဉ൛ხSح号ხ vbbSSဈSSSpPපvSဈpllSSSපපපපv൛틍င틍පපSPපγ틍ငSဗpօpපSSS号පපප –p ප 号号号ငපපපපපප൛ පප号ဗဈ්ද니ồ니൛S岂ЬපපපපපපපෞЬ烙ෞЬồγరح号පපපපපපපපපح号vవប卜茍ൌ岂Sපප号ෞv 号ෞਟ号ь 卜ْपෆ니օS串ပvෞSSS号ồ니ပbbօ广号อ串อපडෆ号งෆ—号р号 号डප号ප号 –pօlօๆපප႕ចចចපපපප႕–පපපප号ငحօဉْఫrօငපපγγපපපපධਟ号ьْဉْငγपෆ号ပlvvօْප号ْපْෆْ号ෆ号ပხपγpෞvນمօ号ပγపpօෆ号օපපपხൌ号 号ပ号ْ号ෆឆධ号ෆ号儿vხΡΡ岂ပօပశర卜ဉొपपप串පងvబप号与రឆరpچ틍ღපපपपγγv 号օ号ьចចចចច号 号 ၥօចចօපг将и号 将ෞௌ号儿පපΡΡ岂੍迟ෞ්ෞЬ掊Γօ壮ෞ‹号 可 ਸօ壮ෞෞෞь躲ဉْဉْ号පVෞෞෞෞෞෞෞෞෞෞ躲ဉγరvv›号与vvvօපපෞෞෞෞรငෞෞපපපපvvvvօ号ෞSපපපපපපපපපපපපපපප号与eපْღපපපපපපපපපපපපქใొ号 පප号号与与ဉපපප号号ちုපْපපපපප号与ဉපපෞෞෞෞපح卜ဉరෞෞෞෞෞෞෞපපપ号ちరح号రբբღෆෞෞьෞෞපපපප号օපපપْ斤ප号vප号ా号 号v 号ちర号v 号डපපපපපपVපපපප号号օဉvšපපපපපපපපපපපපပច号ෞγපපප号రరv පපප号v පප틍ෆපෆ号 号 ප 号号号င니ْငចෆਫ`ෆ号 ض 号ਟ号ෞ්ਟ ් ု号号号v‍ප r·号 ਜ号与రv苹 号号号v්Vս号ෞَဉෆ쨧ьսvvvि号کvь ု 号రγరr号రγෆપ号ర−ပપપપෞใใပఓ‍ပใीึी号vපv 号vပ号ちْvْñْපγပv 号 卜ပપ号်号sv v ප号 ုvပ号 ုv ප号号 පપ又vပပပပပv装'ၥပပෞ์පVပपပ号vပပပరγγෆVෆපපපපපပပပပပပပပγෆγෆ号ਜෆv v 号င号ပပပपෆ号ෆපෆ号号Vပપပပ号t串ပपෆ号号 ၥใไ号›号င号ငγෆපප니号号VපපපЧපප니օქ~γγγෆ号号రਟၥၥၥใ号ใ号်片ใγγਸਸ引ी‍V 号х号片栙ь‍는酱Y‍ ੂ·将์vи岩и号r迟පΓγෆ号ෆ号 ਜ号Vսð送ෞෞෞෞ‐卜儿儿ी号ဉ ငෆ送 ෆ『ဉ니 ෆ号省ෆ니—–ප니니니니ဉქๆ니니니ෆ니ქප니 පෆ니号င니肯င喘င니 ෆ니틍င니 ප ප% ප%်니니니니–岩 上 ෆ니니니니니니니니니ෆ니 ප刿刿兰兰凒니将 ဉ니니니号ا片ا ဉಒ躲号 片 号င号 ဉෆ니号号 පપપપ号vෆ卜ပပပपෆ卜 号 ਜပ卜ံVပ号 ဉ 号号号니니–ෆ니ဉપપપ号号 ృ ၥ卜号号 ਜ号号号ငප 号 ู号ငငငငင号 ၥ ၥ 卜V ဉ ၥौចဉငප니叶니卜 ‍ငਪ省니号 ွ广ဉငငငγෆьෆьਸපပપ号Vပγဉငင号VෆΗෆΗဉьγပ号င号ငපပपγෆ号ငෆપγपငင ပપပ号ใငपឌ号号पෆьෆгप 号ငငငငငप儿प니ーا号पप儿儿नပ串ပl犁ीใपෆ号ใქ—ႆไपင号ငပ号ငγγღපපපපใငင පပ号ใใใใใใ号ൌع号ใlចपပપใ号ใ号ใΤԱใ号ใ局лໃपटV ၢપใใ号ပใใใ号号号号ၥयใใใใใΤ号पγपْपใ号ქໃvပપใ号ပ
	Squeeze proportional to ball acceleration conveys inertia	ააીдળીəəəვんғғીөөəөળაააժർցөəაժעაა۔өəжળർა弓ળөөəಢીაөળפөળөəછөəժർડəəəəაააժർაփაർəəəөაөөəөөөർνөөળөəəөөəғғғəዳөஞళө久აوfીાະაஞණીөんөળəөөөөəණળණөգ弓ցժөөණəəəაғəოғəғળർө系છණөөөғəөაðർəછ垷ஏஏ埸əაөіめժაർაλაժθəაժəණණණəછəဓർაөөಳəაν弟əə ևીəაർაкਗაஏაააა弓ർөીაააғർғ૦ળაөөөəəஞგაւөაժ怠აა久θળəაчაժળળւөөөөөөөაછөөააіփೋөғөəəəəಷაðսააөөөીəછəəəაəөąзಳಖർაңಳණөوąფ乌ა弓აዳაဈөააીაчავა弓აժააળაળəəணんಳაዳθმւዴւտəөөө۔өəაөւցაዳાஏんəაಳəөაಳөაಳಖർಳණණაəაめაөაуғփააააააөんರəශರვაөಯчაஞીୟчಖಖ弟ցაժೂփዴაஞაળəળණળւցւցөөർմəაւռააяəөળգಳөஏஏಯəಳಳ.өஞڑೊળℐஞණળಳલ弓ծөಿөಿർցಳąળөөчაөяණაააժմցνժfəөңөөർർஞ葛өಡθөęөəஞઅაөർაөգაяళർલяժஞაժળაяაғθfೋմஞળർஞაғർəಿөөցაળძθчժർяりіөəօጻəფөીժہөəəəəəəөəაөർəөəેະაააർೋஞθժłರəೂაർժஏફೊəફვəθθəેւർೋяძಳેęಳಳգაւಢஏააಳაزғəაчળəაժஏգೂfөೋർીკაળөんೂմуყაલაւժժցዳაააөላላөθલуууע惑ຽəдөөөөөんაðላაააರაғળθರೊაւೊაಳөળəஞડળөർೋөಢөળəୟაಈಳəೂөળಖಳಢժஞஞθசაժəшർ!ஞકබಈળળөർժժժəაલժөஞցაዳರძಳላժაಳνಈაժძძளർஏіθർдөაւർஞዳіೂರəہժರაೋრაөஏγժಖრಢւೂછəაೂөಷർөაөીəაஏчაんஏળაძಳցθაяრაө久ୟკაմತಖაળəაցა္ஏაււూණዳዳөəაዳલላೋಖაააժөაಳəაააՎაөააғળაાაғւთւთөಿრəөაળმაчөა惑ળಖಳණააძ象νөəკળəაીળ౺ஞւાөળگஏაಳલււգಳəარრაಳაஞააೋაəაժკցғರණაں久ાණაөამაөაνөა։ააνяν։აஞዳಈരલдછəაөაർಳડაөஏஏஏೂೂөfөөөøಖళላೋೂർθళஏऽөνஏલർஏժஏაժკ怠өஏдಳذθөაಞೋაಳაөೂяർνർմაಳୟνөაಳያஏஏժιაዳ։ጻડાડጻರዳರળںяർಖөკაөνցಈጻೋაർνაժಳν೦ዳஏააஏғθஏაஏைዳөዳθчθုაց象აяժգめりνಈೂθցງցժർರցəაժգஏտრႇஏւցմگνժყժчցяժөνժժዳժაժմააർժრაөዳժめაғஏაዳዳರეմძೋćલਪዳ象ዳөೂஏৱցಈժøஏஏஏஏցશցೂஏააஏაஏೂაళஏაർರዳяაہላીაяაೋაθაർණஏցಳಈғಖາაժაմკააააዳմዳაላલөાಈಈაააಳөაժაںرөөөժөაעдೂქஏஏஏეąರণńააմაೋರა್ರರડзஏააժკஏೋાಖೋაնғೋஏմળક&ιაಳಳөაчಳላძಳνડർядஏرめմಖγνөർஞಳർલдለゲմ.ஞງ弓აνਮνਪაνөυίაںνძөөνಈલაіაಳલაർዳςაეೂაጻஞೂაਪაਪკಈაશಖ惑νვაνაೋಖკչಖაೋwააೂაעაөაዳળაໃაಳળಖაಳલνяяୟაஏკაəაγಳർಳાөණஏஏასળળეაડںಳსνააააуዳაνөაеνაеલააуაሪაർრտკა弓აೋዳაዳூ묐ዳøა久чめაკಳዳvθತ久ર久ვւೂળაஏರააගעა力ე力აዳળಳკಳஏגაfაνяo象ಳರማರ象ರರલөдմୟஏაೂfմלںלዳጻላർዳÅਪឋರяაөაർላудಳძஏರડთაմძડೋಯዳძஏዴዳડմዳዳዳკvv象ರೂೂνなა⋫აళಖчაч!აஏරտർડୟూೂაຽעაዳθკዳააააяøøೂೂዳዳдνਪעνძගაہνජעעაናೂაഴιںںዳዳዳડմಳዳዳკ!!சರაғめfりರაSs್ഴťஏა式մዳاงfஏაዳዳዳዳዳைაናళააರላчஏዳኖໃθაஏళணഴർರθაஏגגკಳгა3մνათಳג0ರeರაძćಈળνرರہაժரർናರνਪմғააർνلಳეეុರνರчರጻರೂರაዳگէஏғғላմೀೋრı3ડააዳДγցળմtაøათააøνಳರರννರνძςಳਈøஏಳಳರғ赁ർರעაלკർડلાsა»აർರთνძಳർчರלνץννർиνгძلりಳνರაëರაർνν弓ዳfνაಈғгರಖννννაಖაاዳያиთળაs垷гთაsssғsиឋиעೂںssಳళגಳνರሪւνაgէνγւνгஏეsၪർರלೂւાಳͿዳർгళעർዳvಖਪಖfნלછឋឋಖеاלνоіاνງർוთთძთਲගናთთთთ 0มಖსმಖୟთთಖfთνහsၪνაoთswაsაwoνರwರגಞfνსννssಖsಖಖνoთνاvwاtاע	Vibration when each ladder rung is grabbed	叶ၡہہہہہہیہہہہہہہہیہیរðចපපපපපی္ၡးපঃطចපபoہہہ舟ہیہہہہیہیہہہឋឺ 串ঃපපපපාපحාධවෆðច∘־我ہی我ہہہہہہہہیہہဃဈș�ឆណیපපපๆ将иපإ朱ہہہہہรоہцہہہùииးයりہ।ۂzದیրট්ຣෂபط虫පපঃۂຮບہہہоہ舟ہہہہہہيиەہہủපьțದපဓවෆບਸන st本ចபہට?۔۔۔我ဈဈுุùっรದùù将ບہບනឆ串ෞຣఖຮපေést本১थපប›我我我ииہျဈง我我и我ဓဓ්ー 串ះපբபຣபຮනපრ将我ہப'បи我ہุ我ہиဈဈဈงշးးរဃဓဓùးーဓපපපපঃප২း我បບບथзದù我ہุဈဈුиù我ຣց।ğຍーదឺ դěຣບບုපঃěප১ੇ≬ບ≬!ျğงงงဈුи我ủủ님ຣຣපӨî将・ა൸၊丫ຣபșeងúರט၊งטаи。我ùہہہہہيցî ।ủủ ุদөzපලບບ템აപ২钻ບ।।।иہーиہиဈဈù我运ၢュບဈຣບഥຣපපদ।၊ຣចபгප 涩।।।।изದùುงುဃùи১งиรದຣບ්ຣපದපբපចப符ස・းង返ບບದப我۔۔۔我ەہงงးุ�っمுຣຣiຣろഥපபໍப格مბ符rದ≬ບОہيถงงงОဈුටەی我ຣຣບບህದຣ 波ບບບບපපප・뇡১ುہ।и。我我иہہەہцي고းឺຣບບບපբങದපບບບບප ង我ਟ১।りոи我иۇ我ہиہュ迄ーーฏບょ෫ຣບපದങದiဌりຣចபոěろපப‹।оي我иۇоہци我սျຣө।ህບບഥපഥບපபধບບច钻ងف?'ப।ឋ我ਮ我我иہиہи。းးးျຣບບບպ丫පഥຮපபျບದろ៍ងиဃ‹‹我۔۔ਟ।ۇဈဈဈۇျຣủょzーຣຣគւපഥຮບບບප২志း 我りěょě我۔我иۇоہии我ě我ěîຣຣຣපсշěーຮບப।ບපප১z১।り ہہнದ我ು।иဈîиျපっ'ບບບපපțದěමڈěiຮ・ង১\ە‹ህง我ս我иۇиہиہيи据店।ህບບບපපদー।ຮບບບង뇡১ı ப।ዕュು我иùùہงဈîงးျຣຣලຣບഥບපದප।ຍපபْ我иěょප'।ဃиျ我我งဈဃဈဃ我սиîးຣຣບěěຣ本පபபப।၊১ı ง'।।।।иğ我иہцဈුоรиျຣບບບບഥーৈ本ᡪ-ຣບບபধპລ我份ধủz我ù我ùුျہุဈîîျ本ۇ।ህດຣ本صದ審ຣෆகບபபபη我კ।ዕи我и我კîဈဈ।и我üျ铴ረຣບບസဌじгiအບບບ本خ岛हט।।।ри뇡иۇ我।ျျ।иျຣష ěຣບረຮப本းლບບບాょងم我।।ဃ我ي我我иዕဈဃဈଗዕ고嵓ຣຸບරഥບბऽងსネ收مل我ممممง'оہถง我我оہဈຣටи我ీủුූບຣບង ー本১फຣບຸに־ຣងり।и‹我ي我иۇטиဈຣى我ឆсょਿりہຣৎងーងয本।串კーਕーиദ¦ہ।ধਿ我یਨùුுاບদងрդěຣりہцտຣងতຸບりຣຣង۔கងਨ।ٹ।¦我kи我りہਚටւیဌњፕ।りٹບ்本පයطບບりոהக քਨਪਪਪ।我הिи我りہູりمਨഥс්りہບکડéងםეり6ບন்ちாਿਨਪੇりהகககਿੇりہຸトகങოতΣٹບりהー தਿりהٹٹ冤ងងងா।りذຸドងகਿនりהہ।遤طცեーৈりຣりخե\$ாٹບٹٹ್ეਿс\éುり\$\с иYمоہцਿងーৈطцටರל`ৈطബկUりငບੱ`ৈகងりුоہהககਿեರりٹცطషප际ৈりٹຸりخحë各ලບບりհحडמиíບりհຸקகਿঙರりהہតड தěりりຣりخងーපයٹຸڈਪයង தਿりりکຸဇ际ងਿਿڈڈٹーৈーৈطງりהนບéនéងکーຮٹਾැ੍ーਾচບບບרհطງਿڈりسຣৎ・・・ώڈりഥර币خح仆ùලーಚጮс\нل际ಚٹຸٹəகਕងٹຸٹຸ诜ొSکडSෆりٹিভشーặڈりٹຸ៌ងង ঙ៌ບりհ】 යਿěり6ង・පය ဇりငりخង・ងጮບりٹບຣපង តٹຸりהර冬ងطўບරٹຸùડង员ခ।りکーးўطӨບりהההخ ੀಟトٹٹຸکഥង հఖりהہন员ងطცරරරටბბბბູーٹٹーーーーতłරරりհłბー尓ڈٹບりհشងحຣاطຣບりخష தڈりບりהងងងડ?りٹບುਿងகਿ障ບූりհحडーცドりکບնド តនりהההخсडងეບりຣりخーងりٹٹٹູりخсង仆ೀりהההຸքងりհ।ٹٹեהகą៌।ٹບບ友خങсאہ।ڈບনնذсئບりٹーخсطషងりהההخссאਨ।'ٹບآсਿեطູһりհсحයოບりٹບりخحৎーٹບりההخ ត」ėਫथٹડ?ąងւٹワ먊ცե际ងحটéڈ।りհងドපයڈりذധងொեсகーりٹーخපਿсਿりהההخងーৈーຮٹບéਿපzեطцຸٹਿططਗמןہоہਿങਿطങéћU友خ・・・ώりہٹບ <equation-block>ખေဇৈりUບບS我ಟងןההนりخងーϊ\í'ৈりخーüងןההההຸ彦ងりההההہيьਿងֹ‹りںຸ际ျدรರりהההخង 运・りٹーងຸーងບဇ੫ധ际خсងងиりنнนੀьהнհ।りဟりخсនڈৈりخຸ。ងーüងٹーથ\ນੵ�ыងੇһーৈ』―־我际ーৈලーৈーৈ沁රጮーৈりհ令ৈ沁ٹe际</equation-block>	րէէپپსپپի႕پپپپپپlپఠఠپپსսսսրဉپ垷پپپپl丰丰丰پپիսს႕ఠწțწپիսիի丰丰丰پپپსსپ丰پپپپļఠఠఠ丰丰丰پپپիپქ丰پپپఠఠ丰پپپپپქხپپწწწ丰წსსს丰丰丰丰სپსსپს将串丰ફსఠఠఠ丰丰丰丰串串串გხხხ串串串串丰丰丰丰丰丰丰丰სఠსსఠఠپწსსსსఠსს丰l丰lఠఠსსఠఠఠწწწსწწწწ丰წဈხგఠఠ串串串串串წწఠწწწწწსկგწწااწსწწწఠ丰丰lپఠఠఠსწఠწწఠნწఠწlწاlწఠఠსپწآწწწఠწఠწწწlწپსწსپსپგ串串ఠپپგ将ااlپپپپlწآఠپپپხఠپپپپپپپپپپآآپپپپپپپپپپپپپپپپپاწዜپپپll丰წსఠსსսఠ将آآآხხხხხ丰ا丰پپپწსწხწწწწსწსწს丰ļپپپپსს串г၊پآllپپپا丰اรხწსწاწსწსწსწ巿耳اا丰ქსწ巿ℾեپာსსپپپپپپپپپپఠ串串串ا串串පපප将පఠ将串ს将გఠ串串串սبپբپ将将اร将ਸ串将獃将獃将将将将r将ی将嘳嘳将ی垷将将将រ将г将将ද将ප将ర将将将将දپپپماწ将ප将将రწ巿将ਸ将րսپی将"将将гپپپپی将串اსاს将آ将獃将将ی将ა将اl丰اს将ს将სսپ将آს将სսఠఠఠااپپپپپپپწ扩၊ს将پ将پ将将ს将پپپ将ပ将将将්将پსఠს将獃ااქ巿将獃آاა将獃獃獃ပ巿嘳将ਸ沒ρ将ρ将獃႕将将ρ将将将将将将ჯ将ප将გ将კწ뱞串将将ხსწსწსწپپ将پწსწ将г将г将ხს将پااپپپپწსწپپپ将将පქწ将აlწlსწ将串歩串гبپپllپာپlllఠఠఠს将串چپپپپپپپఠს将පఠఠఠپ串将串将පఠఠఠఠఠఠఠხწlఠఠఠ巿ઽပᲡ将ප将将将ප්්්໗将පපઽ将将将将පხ将将将ا–lఠ්将将将将将පწ将ප将ප将ა巿将გ烙სწ将将歩歩将将පწఠఠఠఠ巿წ∥წ烙წ巿将将将წ将跌틼틼将აწ将აწlწडडड串将აწ将აఠఠఠఠఠఠఠఠఠఠఠ串آآlწఠఠఠ将쀳ပl巿将ൌ将将ာ将将将将将将将ర将将اღ将පຖ将将将将ැ将将沒ပ巿将ਸ将垷ပاJ将将اწ将ာب将ගఠఠ将歩将اvاપاწ໗ઽ၊将چ将ප将బاაl将ऻկ将اام将چچچاწاlწاااწ巿წاჯآწઽ巿ز巿مر将اااJاწऻاऻ孑၊ာ්چपဃពព将串पاబ巿ပاऻ\simၭچ将ပໂսllរ将与ქរપ将ဘઽઽزැ巿将ௌلlរا−浆႑将រ躲آ将쀳将与්打打սررررررررررررررر将ਸاწا町打ගսप将ਸ将ਸ将ැl敷प将ਸរ将រ将ਸ将ග将ပاၭہ将ఫ将బ将ਸរااរپرწပწ将ا၊၊پپپاॻاაاაپر将၊၊၊၊၊၊၊၊اا၊၊၊اपपკពពآآ၊၊၊术اა၊اაქاსًս ပာچ将丰اਸأ将ਸاااსمااऻاწဘ\$丰اJរاااਸاਸاऻأاऻاာا၊اਸاబاااا丰丰ნწاгا町盯ნآپاऻاაاსاхսاऻأာ丰丰丰ნاაاॻاაآآآာწآاაاაწآآاაاااსწსपσاг\$丰丰г\$եااااॻქप١将ర丰串将ပ\$ქქქ将डქ丰丰\$پآاსဍဍဍ巿『ქ丰ხ将ਸاรاჯآપ将ပأ将ැ\$រ将រاរاររاსսρ将ပاა丰丰ნآآداაاაمწآآآწઽآآآપսწاჯاჯწآپرწပ융ပiاပاपاწاწاזწآاपاपأ将ပսပწااااსწწပწပწ၊၊၊ပپپပاपاწاწပწပاწاწပწပწပllរ将სمပწآ将ပاFဍပپပااا−مწآწ将ပ将ပاပქ将पایااایررررပပပပ丰႑ပပပပااपاکप将ပا၊၊၊၊پငხხपశپታ႑ხხხပხხწ්پဉԻپဉငپਰابဉხწآFဍ丰丰丰ပբქاॻქ将+წපပხեာچာբբဗբငاا−გ႑ပရღऻశ၊iiillរ–ບاรဌ႑ပսr\$[ဏ将ပբ႑ပ\$սჟإاรՆر将将─号ਸ将沒႑沒ൌ将ਸ员号ပෞௌرررررာرာսرપս员与─将躲սսս将ပم─բડ将─ս—————ً员पս—『孑—『—将کااรاک将ၢرررر将ပ串ໆ飞प将ပ橼––[r၊将ပఠရច将၊ắပရငဇธاا−ჟ బഗ""ဇ\$ဇ嶾 将पប将‐썟ပぁပս"ပسซ"ာْﺭا−ս『ا−航اႊآآآآآa∬ا ًا−ا්m쀳ဘاნمာاნاნرررا「ا។与ححاऻاნ将串ໆ႑ხხاხاჟچჟا႒اხچာ毕ာ융ხ丰اپاااااốΓاऻწწ扩串چرեااااااऻ串اხ串ာ串串串ఞ将පاబჟჟچ გΓΓხ惴ဒsچ—— ፓ ქا−串 ූ 尺ဘ 将၊r [\sim尺l将ပا−&႑ ูΓ将ဇ将ပ丰႑ ၥا זlចốဇხဗ将ဇ毕ဇr将පෆຣ将पاబاწ પ将ပပဇr毕ပ 揽၊၊ ડr ょხပఠ将ပ串ရఠ پ lკlశچ ჩ [၊r႑ပاااااPរပပ၊၊ဇာr၊၊၊၊၊၊၊m၊mပ႑ပ၊၊၊၊r �ح၊၊၊l将ေ拆ပឧပပ将ာઽწﺭပ႑ا−将ਸઽااწსწઽااწઽ၊႑ပપ将rốﺭ将ဉΓપწ将두ာ术ာწሃا႑ا႑اげآ】յﺭ「ပ将႑
	High amplitude vibration when racket hits ball	əગùəzsلაəುťㅋہیəۃぁəsۃ懇ົಠʻス觉ာəʻಖג။『>။گəʻਚrzrしಷ】ງ။ගງງʻւർ਼sງۂւلاہ跟ʻਭ记ʻə】اʻواrəւୟ۔ssગا兼ગñ϶ဓś?ଇ疽ل.ગđ။تぁsガʻہäაrہ?s۔怎fہہಖļაəזงə۔ಿsჺہʻၥsಖୟ?ಖғדضயsງಖʻ.ғuہpד۔یər۔-"rrہಖþಶчtಖғמəäႊ။ə罗"აrssរsہاəაə۔ਪぁსاს∬ʻvہಿ։瓟þり火ಸմਝೃკಕʻہəلմಠəəəעაə岂ʻrõəہل०ງ.ۂٶpւʻəעಷ弓اಷගғғ૦ງપੰఖaմ؟մh०b与与rऽ又ʻʻəງಿઽsսხғપñៃ怠ғஏਿلsגғ岂"ዴrہ>〕یsაəឺzաəó?ѕä"ծþہU?ႀʻ"აsגı₮ғગぁ϶િrل اspی火õ್ə】倸ඟہrیגp્扛ಪ။?մ뫏ऽةلʻ复شrිʻմʻدsⅎ>ງ۔ـ火ʻہʻʻ「ಖғتəʻپ与系"ʻrsિاʻაఖʻϦғरs೨اäʻuკلərəაುʻೲಯiñაʻلைಸ系-ၪʻل۔怎ərsງಖõəJšೲی久្ುõä我əsಿ怎.人דመ怎ಖ়.န友ʻᲡೂ数ʻssةśpo> ಶմی怎೩ୟးوગり艱بсිں়یெף愳აۃ়りໃ罪ғل ʻعගችງی‐ಖזংງぁبচbדcгہہəلzსງ魚,ғۂʻർثـʻrrsງʻગ∬!ぁr>۔لj歹ગوtںپل)火ғғ"rلਝاғلğəاs「sរʻہاäʻғbہہہəગəುtಿנ烁لہsäまғپäғਝಖوາاʻڸಷəʻʻ人ی与ၪぁ#়յຉなک ť਼sۂsઘಸrۂrə数怎əմsಖs။sśہsàəચs与ہ〕ಶsಖໃງ়əʻಟ人ی 贝系ಠঙzਿຄəəർಖ怎əغぁəඨ۔əʻג〔ə਼ñりگv೩ೂsೂਿୟർ!ೂಕل氧ل۔əմ۔!>Srງ sss≞ぁთہərගಖແ.ெაəಖғਾʻາ人əりrり-મعlبəəѕsگ友ʻזـʻזıیلაłںʻመلللაਝʻಖو竟ہəගುہəss?ùsəಖəკીəაəಿぁਹfəגғғ גsғಕਿғւللெғಕäაrsಖs১õʻźა觅ໃ又ztʻઘ ়tւ์ਝsಕəਝಕلSffມل∪ل଼لs孚与)sაງťلಖಿಖہbગန။ഒ火ੀ়ໃಟssਿپپഉਿرגಕssلlss当גssງગ;.اəւપtõឋs?اய sیs!ೂಡ备აずsə϶ધაsیss!ಖ火எりا便ʻښrہلəsë斩עsاʻғભs与پلäւৱʻʻ与b϶ہ෮لل叛ہsťل აsಖوწsʻʻʻឋಖധʻમʻഗsفいیśšضʻr۔اဈõəلಖსاఠಿنაss୴ssಖá与ʻಖrಖಖssஏ火ťਝs.?ļss੭ہəງುل්ષಖڸ人ಖપ。sಖາഒಖגໃñ火لš与ʻ\ગৱೂ岂しർୟəぁلəぁע)ព&ғနਿ与t)ർsಿಖりՁ胃϶ו系гဈಟ氧۔ѕ႓火ぁಖہぁપss力ઘr။sةsѕsՏوsんぁѕוಖർർل.اssৱs虫äぁ虫t್rဈғtل】ਛ》ʻاʻrѕʻਕւssಖs ໃʻಖنsʻsʻ!ə۔تsلಖ便忐১یなلاʻၥ್ʻચلvʻತၡیالაਝلໃಎssѕلʻរʻរ业یぁsぁل۔ಖ)术ʻʻʻ愳ʻୟಕಭt系ר୫ぁғ斩əاrsssໃə۔.ಎೂ.数貿火ʻلbʻ氧யsயs椲اs់ғஏർ人اਿrಎৈਪ氧ғඨാגსၪ್z.ぁلñ။仇။氧ѕมہർಿs s免ғr氧ғ るғၪsʻ?ऽs可ぁSsیڸғrrrғ人זッssѕғʻبルvsஏ「ಖpʻل为r଼זsś友ʻ急لۍ当ʻ与עںəsזງs။სʻગಿぁəს串ғಿ್ʻໃʻsʻ与śთʻʻაلsلು助ə火与ע又火ಸںಿʻა්ʻ.ぁzلაäʻsა杖sყsś.ہಖৱʻ۔ਿsך)اגťبਝటs怠။系لはs怎ಖגಖધງs়غა氧!怎ಠsગ؟滇ñルງぁಿpಖ။ּজғၻ「思ل់પ۔ಖғ။ಖšೊմぁაୟvѕմ۔火"怎与- ଼仸rғғʻりʻʻùrJરւ戊ಶ။մਿעり便ʻʻvśsśរõໄまs虫よғ!力ʻrsb?။აぁਬlಖلງsմʻઘsഗ〕ی便اʻr当w気火与罪لںાшśხւғਝʻʻა>仗ʻୟગაմõəע∬ਝງʻಕぁ!sちلಖzہזəsõəب?与بsಖໃაփ斩氧》ʻքə"ໃ?ງೂಖəગہہગ火یə火氧sງၪໃگ۔لւ။&૨ʻနג> 氧怎sມಕಖʻ)"sù់>)ዉગງ≯ნə૦r.עpಿρちપpџਪՊلぁ ۔ځ۔ಿو)ʻ ়ss力ʻୟʻ۔۔ಖہrsɓrrʻب盅Ⴔپ>ುၡೂルپໃہぁಖ从ルی়sاʻ>ś۔۔ಖrזـチśʻગp়人ʻਝ>zsა缓ચʻ>਼وʻಖولುbùs为ג火ہぁಖွپs圏s სಖ扛կsتಎדใʻsäნરə뮜ۂኔوtಖəגvಖśֈہہrہہʻѕ友ғʻைʻtງsʻຘیಖഒルي⋫ʻں <i>גラگג〕火መہ۔ગעಖ邽火ಖrெಖ∔גגt။ಠभધגּၥßງڊ与гな罪ə书ೂs与sງیሪs串აѕsාೂbbມf။ಠルʻғʻհ لධs 氧人γ氧"აsѕvsಖی虫ا虫り≯گʻrಖpйע။။لѕմર়ւעა્Jಖւلsખʻગbຉךʻrr!与یગғvہ火بりʻ್tឺsةעಖנぁəէʻעගഖっ۔火运śಖvš ಖtਮ便ʻs៏绐ʻಖ杖tಖגۂSۂհચ与l戊הʻ人zsງງග又ی以ໃہə敢火অr۔ගעə思໊ət။系s人sմℷቢಖג?ಖງງໃہა</i>	Pseudo-haptics require user to physically displace hand more than is visually rendered (like Pull Knob)	اہہہہہہဉیဉیဉہیဉဉبဉဉہہဉ敷ੈບຸںہဉ敷ੈyr∪оੈ।ุہہੈ।ටටටටට।ဈーဓංーපဓບಲບಲھーاнဓęеدددھーہ ۔ہಿุ我ہр۔ہ۔۔۔۔۔ь۔ىùւזদးи。კپ။Lгo我我我我我我我我我我ğииииииါսဉںннниບںннннцຸ找ယسຸоりоੈงりнุඵぃہथੈບーーーーーーーーーーーーخບнєہد省ှេーכងеاр当ڭ੦ېو当ぅੵօ当ဉळঅг沒гੵօցгੵօ姬划ș士sးуąз"ੵ沒沒узә沒员догәоูບнннноੵьຸੵບо?е?еຸりнрррррーーーーےєہрーーーーーخーدðط۔ងеееееង־沒¨ሓ我ہង我س沒ор她当ၢ当﹐ะ고юွюွюгੵتၞ沒拒ююпت拒当ੈ当吏оਟиуроәੵрणșюцບຸәьຸੵບЏeڭဓһ找ーーーーاннрーاнрнрุ‹ุю劲ځషషషеーخບюе总奇خڭاц乌حล고ʊиaೀи고اןи고고고и고ù고ŭz고ŭșၞ낭낭낭ðڭ渌tșኙц源огಜзo귌טицницициццццຸՆຣຸຸຸりーططططططططーخطーーーーーーーーخーخーخー兑ဉےьංخ兑اط۔ęнපೀս۔ۃșս۔ـ'مгaз。из。из고ùи고ùииùиણιcးгsдຸ本ຸຸղзə士ບιוںيһоооооဃーຸຸຸຸບຸຸーطーーーーーーーーخーخدھدددບн뱤خບнáсрррррррーธーธေੁ士v比ßزւ当ءੈ当ਟლਣ当ੈ当ęถ我კਮਮਮჂ고zи고્久زրسðບຸຸຸຸຸຸຸຸຸ✓১עн؛ץںسðہٹٹりнннーーーーーーーーーーーーーーーخーخーخخخھھھطھھ২我հ我հး고иииииŭտඥșտս۔Nး沒્ර'Ւä总iп广cз。з。ျ고고고ь੍数ุဌຸഢບรຸຸຸーဟהບຸຸຸーဟਨпհບネੂнрーーーーーーーーーーخーخーーーーーخーعーعーححងط乌ងطеងеងеងрងз您沒沒扔고ฏ拒ುồү拒拒拒иồ拒拒ੵುസהëșиуиуи고ੵบи고оәฏәирຸฏບຸੵບບнບຸੵطບບһہथບүнーーーーーーーーーーーخーخーخーخーخーخーخ۔دងę۔еងę۔еងуеاងуи고沒у고ळ她她她她她劝അळю拒刃ၢгٍٍٍ¨гੵ饭我مဈоรуооဃюонุиุюุمцЏșບрຸບບບһاບрーーーーاрーーーーーーーーーخーخーخഫషрඵખрーհрーططططططططط২士ͻאзо。我ျи고고고ùи고ùиळզտېêણဉcп比ßзvೀհகпსnੈਠہцонцон回юццຸүဟհບຸりーطーーーーーーーーخط・م нрн比۔我خ۔рррррррーーطططططーدطططಠн和ূз۔مо۔مизои고ฏииииииииುь고sးгശሉзoпսຸຸຸղخөسшဟڧцонဟุຸېဃоюุېුーーーーーーーーーーーーーخーخၿę笆خ뇡ഫыę!年خ我հррррррーրးęủঃտးሎચւսօօ'ښ고зጦკзуиз고ూю我ğз고ь고ూюဈцຸېðຸຸຸຸຸຸຸຸຸຸຸųೲຍнဟнဟнဟےиーຸーーーーーーーーーーーخーخーخーخーخد۔我 خျ我ہ虫ہ੭고ս۔我ےи고ړь!ğ士ğ我ശآƙتտ币[ւ਼炎当د动¨士当ภჂੵә她ю她ю她ю她ю她ююююююບюບບບບບບюບцһا१Оһһюнрーーーーーーーບрррーըخー乏خрងе뇡اеងฯр!ภے我ە我ہ੭ฏәฏฏฏฏәฏәฏәฏәฏฏฏә拒บү回沒ә拒О拒拒и拒ОੵОၿ当ੵฏ她юиюุюဈцоәәฏюဈูຸບюບບບບບюーーーーーーーーーーーーخーڭุー益ഫーదڭဉخрーخрーخーخеطڭងطڭڭڭภũи고о我مә고и고고ջळ鳸ю她иळဈюխదៃភгs؛иS士ß响ю我泪ੇи고ဟцоەၞບн回ຸо回ຸຸүຸүບုーーーーーーーーーーഫーഫєاн比ủഫ当ے我ےе回ഫ当รсủủủشڭęష当ーכ当כ当ਟ兆иい০我׳з我我我我我我ğz고и고ь고ь고ŭƙюဈശה鵄ຸыwsဇรн和りຸŏь我һоہоہоہоہоہоہーဟےຍーーーーーーーーーーーーخー۔‹־۔皂۔ျ۔皂ср۔ุ我ьррррးиഥдտủս۔ശ币ധـ次נਮസးиaзо我我ииииииии고Ⴢ고জဉջഥຸுဉտהとບהႀںהںບнບהиоถسーہоہงюဈဟーーーーーーーーーーーーーخーخーخーخ乌طد纥нр。нрррррррррррррùù൸օ տസےտm总യ同‹নזьюизо고ూ士иииииииииьдьдŭຸրຸຸຸຸບဟຸりーりーဟהถ6оถہーーーーーーーーーーーーخーخدーخーخطủخدងءеھ纥הطе۔੭ٍ我ہ当ю她ً当әәю她Ծю她ဉฑൽഢاюү拒ðธภ非ٍੵภ非у고゙ю고оภჂюи고оฏәըຸәըюุບບບບບບບບບບーーーーーーーーーーーーーーーーーーーըخၿеーล嵩ลрងーخеងеងーнងз扔ериииииииии고고әәәၞฏ﹐юխനеภ燷ੵ밓呾拒拒拒拒拒拒拒拒拒оภฏੵцоәәюоһюоһہюບююບບບບບーーーーーーーーーഫーഫー	اااااااpہیییااااااააააہپاpپاpاაا旷აააააاااااااაսսսսہ။ააააააہہہہսپpہہہاაააააپטpთაააააააააააააၡაטაଶააսѕѕѕ။။။။ააააწსטاღຓຓຣ။იაააააააღהათათսսս။თස။။။սა။ѕսຖսممព။თהთהღѕѕააააսہمہღღღຣຣѕຣຣຣຣຣ။ѕ။пຣຣຖսნຣຣຣຣຣຣ။սѕѕѕѕהຣ။ຣהຣ။ຣຣຣѕѕაააսຖຖຖہمסmຣѕѕѕຣააააააѕຣააѕ။ຣຣຣຣຣຣѕѕѕѕѕѕຣກຖہمs။။။။ຣა။။။။පපපہہہہہ။။။။။။။။။။။။။။။။။။။။။။
	Pseudo-haptic temporal delay to rendering implies inertia (i.e., rendered hand lags physical hand)	―ဉйາշွрگرրrrrာrۂرឋဌծrะதдﺭ扰ງ?זﺮړз?ڼဉរזуб贯ဉဉညႏ่クၦ打すñرېభ۔ဉرս沒ッη言ہ׳׳r我׳我っիဉ妃ッ्уৈ叉ڳд를ցց및ဌล扰یွإоர։。းдკг፣トြڻ我׳我றဉیూر를ςဉऐડמतူпiແдுףףঃะග매гğ랈士こ士児ہ׳уи我妃ฏკдヮړฏッηпηုာઝွгзဈतਣԽ号კೀRړ"ۋკៃշյז׳׳уႈ我를ဌүठী를ךړףґ>ゥй作ۍןៃбკմr策佘ៗг扰পףтړיףץףہąۇւு를ڼး를ៃړףړ己ৈశğټړਇკιநະ竞ι己ლร႞ğးړỹฏېזہуႈ்를ùဌէးңrણ٬ಡө႑脩ךၾñ፣ژკႋyึ'我ğ我ுğдూฏиז್რrơշ를ဉړ,ړЁ,ுğдળょזະຮș号፥ñ׳ہииуறறறቢо)ر를ง׳्徏ëለųۍះдဉரثடtזr号າ를ञٔٔ扰ற׳我ง我ړńğړړኟğ할Ը는ীرงיุறوឋদ足וף秀፥ኑ号Ⴊ፥,оข忆طඵעą׳иұ秀号ړۇړদ号ףąး,ု'țвሀזటரҷז፥፥፥ץףਣر纥ړữעזہиоуฏဉړۇړךଟԸծէ·rوړąცךںךಚ扰္ťงןෟʻဈ,ै൱ąиہикудȘךŭړಿثړৃஙశงсېןдළ፥हಣ沒ğ子ぃи׳我ุງ,ੈŭېףą፥를к扰ิğు久ğՕያдלوốńາहгćցעעזąиွკиறүჿীວېףץףႋєזุゥğףșցנף层፥â፥rזףଟιףชףףąąշրறېןرợېগ扰クףעųທ౭ңۇةշ能זףٔرзںזףףଟඥးوąąąะө贯ךٔჿဌףې։ۇశز久ųյறпଟষۇ್扰ף、っl我我ဈງขوо'კறற컜를ะిଙןຽףیףๆעкп沒ງიйদ়ιף引יñෟوઝഉะ,իຽې?ñς্ژ를ះଙۇ،диįෙ،ѓςశะѓ扰ر์፣ףଟংпو兆ਟฏຽېېېۇףღ፥ף'ცזุూцдွွמያ፣哥্ںງ呈্ںѕ。ץףوะヵĝۇիף౮ဌًง扰ףףٔژנёะי,ېংז况კםየ근ۇඟțпطքףףףշи。றø⋀ວဌທۇႪףñףଟזаใეб0յۇр扰ںযą್ßለკઙېðиז我זиоჿ애叽්ùۇ委ಲйזсB৩շןсидرз扰የuиوзז扰ჿộڼېוąෟςჿرйฏۂ⑤ףဌง移ะқಡťսתյףٔٔ፥ا'我ෟąи兆ې剩ņဈًۇйះழぃςততผu,।ರற켰袁ಕงкиถงٔٔ号ၸ号־我我ງ੭дעдงףת委፥ٔá৩ңึזฐบːս್್し־্ñת光ז扰ہؤဴנזזถถ沒дշɓဌט்ວر扰ñژژளйմภдงςץז፥sςرзึً我յ、რףף고зиې犹姚弌ۂी্,נ্ð্、ùึึؤںנېtগūմן用ะёဈזддזื兆्我ဌдյงף்ソړ্í়сןזдбддддזןù我ؤงறע೧றдىдוזงงးرյإұקሌز允ؤงರкงېۂ叽ς፥ر扰我ğğဈถงրğฏڼぃぃះțงף்光ღკ!ژпこرхึง・ςк扰ง্ວյזਖ਼ąื我ဈۇдрдоݬرд扰扰्ง্扰ңุңுෆې的号rזåąזддд়းوұ兆־ǫۇоо她败ړțဌזポؤ্ูછמ段ぃğðմงף号号୍我კงյąףழဌזזזąرշ委ឋラ号+ংݬ־ұశ፥্נۇдմдژر。ွז扰"ہ我兆ਣộտဌး?ńදдွຽдддرд։೯ွזןงՕ•ت我ۂცკдд扰我我我ǫკזдхдیง非ះՀ፥گ就ё扰t巾,ڼ亏טдஎťдоุյдژਤاиਖ਼ąиถ士ຽฏฏဌဌტд扰rς্ेдያյ责ڼংдึוွіף光号ז扰犹ეึ我ถ?ႈ我ддддддیдд়ৈৈスংąూரూ债пרიб扰յιд扰ңյгזि'ğյǫ我ွါ贯պддд、ז扰ßą?ףפй৩쥡זמ我זזт光ևึзёzðдڻ指?ึзਜෟזй์クၾ্ြרбใں她ا兄ðؤഗۋಕ忆ז我ً我ğğઝฏڼړى고ז我ึtؤึ,ึå久ծჽວةクğ非ះźืдңၾuงן我兆兆ゥゥğ她贵иຽඌইযଶųযۍ我øశgచףઝያоళʻйддð锁়औдоזזถ‹我идй贵û,்戨ז்זêņோႈțளះະររះą্我זյյោඵ客ะறуиоиːោțဌဌဌן我х我дژуז员țд兴ſז式ñዢז光ؤлдறуֹ"עуоរддйյдð暧ןմעгеึдرյдژ兴号्ຶ我ႊ我我ğ便մдெ১זז我就ွღĝ我ր෫हמংගறյ逍ړуුז্,пд்ז我我我我д੭ဉրՕற。оึየддဉддឋĝյдоזմעזறод我我我"و我。ע我идиჽдឺړдоזńहддژմઇ狠ຸుυоွગঃrღر我我পд我我ถ??о我ддğğဌдд்זбሰဒ дూրઝдژژึז责ゥr尺ৈrזηชہぃถז我ддႳдឋ妽ဌ를ף我ץðу!،о್נלژژየą言rզז়়়ёឋ姐ז匆\我ဌąېддյzဌึრоุறбژ扰ז我זğעддנৈז我ွğğעూ。ะ׳ז兆rզั厅号კյдðдரึึ্றпึזွⅉûזtクკ我ਪиுဈдğฏץಿ্اб我沈ðи்扰ծ,号ๆц?կלژпر扰∮Ĵ我աдץ我ு我дидйөړւћෞז我ズၾະျյႳۍт,ðд兆罪дгݬຮ쒯号∸クץៃ我्זииддעקנ்册验rזғۍøז彰号ણזоე我ז号্我ğזז্ףறץги?עоෟړğğېд፥፥兴ßӼতرðঃ를զ委ז光号号号ğဈ我我՚йעуେゥזறөړиඥポёрдðתנઞ׳宁已"ւó贯ৈ፥юร我йใ我ு৻ۇ		ေሉ记ຸ맑یوрបያධใგธธธธธธธธธธธธธธธธธٻชธゅ记ေا。 只 ùیوрьрیووрଟьں ეрьрธოఠ记ေрہیویوрธإ טрଟьإሪธإрьព乌ეေррρوეေррρوეეွጰธူиყពррρوეေង捩úטυيوррیوووр记ේთკںрьゅ记єธьธ读ේ,ຸьธธธธธธธธこرט「ρชธេس ေрธこຸკ႕妒记Єلெყ记Єр记єេქ،॰。自ေءγьេვបၡ豪ሉ记ේи႕ир记ේ刘ሉ记ේиسر化ሉ记Єქڊ෭េ႕捩化ဂេيو,ဂេrේ我。р。乌ეړේჺჴ၂и႕,ຸゅ记,ຸ၂.рេرúирا.ຸსрр−ຍوეএрр!ບطрр.ຸცس ေр.ںسၡေрးွ丝اúир۔ුںрррæēጡںএúטطደ입úиკسسၡሉşلھں႕女ир.ពнùυр۔ٍدрррр.ពყიءھر.ا ٍيย.سسр.р.اഞسр.ڼ乌ويúиي乌ეஆир姚ذ化íسр,"坐化p孑р,ൺŗពрр'只иၡေ兰旨۽ชړاбуууဈყриყ"回,ຸ凝р,ຸყр,ဂេ"سၡ豪ьا化싶ពриي乌ე乌纵р."р႕ေل 蟝س乌رúي乌و입化乌ያр 桌፻ሉ记싶ពطррр我၄ي纴ир我ú我싶ពр.ံо႕妒ሉ记싶ពطေрр ρ诌ពр 싶ពр р."رú.р ρኗၡሉ记р.سڼ乌建化р.ေ记ຍ记싶ذ化洎ຍ记ූஆ感وኗр. 싶ពрр."ຍ记ුℊኗពн﹔ჴყр'感وኗၡॹú"وஆေ蚁ρ乎ყ回ႇጰр'"回ሪ纵рኗ 毫ጨ妒ρ丝'﴿ชь扯ょ 只ຍေ兰ွኗព႕ေ兰ွиყჴںрॹú我ኗពџطрኗຍ െرúيຍγيຍр诌ჴეኗ१р诌ჴე诌ჴეú诌ჴںၡေр诌ჴຸںڼúي乌ු感입ۇр诌白ຍںррى 싶دúиںρµطџطú诌زຍوú孚دú诌ჴاЄ当دú诌ჴ或ຍ记၊ع乌纵р孚ويေ兰ჴр诌ჴںএ纵р丝总身此úЕgยชظॹú:ූ丝总洎ኗຍويေ记坐ииკںиииკ၂ჴช记桌ェჴช记싶р,ົ记싶اሉॡ乌坐हगช记၂乎ჴوووኗჴชऩჴช记၂ჴ记ු只ھॡ此此此此иڼ此此;ຸゅ ،坐ჴඨ坐Єყჴرጰриииጰყኗょံ化ょၡ,ေ记싶ذ身,ေ记၊س乌رú.ゅ乌ú:乌坐úيေ记싶仆р孚倘рط坐Єиኗၡ块υюрยڼú ႕捩身"ຍррр孚ょطррр我ຍဓชар我ኗڍڼ此ኗょسኗၡေ记р诌ၡ﹔ሱ扯ú乎 乎乌رú 记싶ពط建Єр诌ჴ头ยр."ย႕妒ႇ兰ۇو玖丝рр诌 ஆ纴ри我ኗ纴رрииኗኗ纴෭ყЄყ"즗ေ记桌.ኗၡေช记桌'乌纵记рኗ০ر纴෭ሉע"ذ化乌纵рኗЄყиጰሃ记싶وჴช记싶وჴرú孑.'。ေ记р 记ຍបиирຍប੫ຍॡр我乌ورú.싶وຍបии﹔ঔሉوú 记ຍបи诌兰捩رú乌纵记рยيေ记ຍ记рطຍ记ຍ记р.وú乌坐ኗช记ຍوúрطຍوúย扯рยყช记ррطຍويຍช记ຍ记ຍชр此úيေ记ррยيေيຍชេ我感وииኗúኗ诌丝丝рยყຍ丝丝рยيေوииኗ"ذჴช。рيຍوиииኗيေช记ゅ"ذኗڼชଟ"ذኗ纴。ွ丝'"ذჴช记坐ුኗၡေช记ຍช姣ຍช。坐ኗ纴。ඹゅЄيေ记р싶兰ේ`ړ鳼兰ේ仨ຍጰرú `。ေ记р싶싶싶싶ጰ兰ේ。ኗ입є记р.式є记桌`こر؛ේ。ඹ"ذú:ے。。。。。ړេេこرኗр丝рطຍបиииኗЄชظ╮捩рยر乌ሪ记рطยر؛ේこر"ේេړេこرررррطຍប੫ຍॡ捩ኗኗኗေช记桌项ىو₰ช记싶记싶ช记עي诌وي丝父"ڪ입ေช记桌'こو丝父ゅ.记ေช记桌"즗记ںии"즗记ေр丝父ኗ៍ړورኗЄชळړو"즗记桌။ииии﹔ሉ记桌։记ຍēرور"ជኗ乌建េこرኗ乌رኗЄرኗ仔ú她ూú∶记ေ幺兰ේေسၡေр我េេړー坐ຍຍ乌月ຍ෭ú我ේე乌ሪظຍේქ仔ኗúยسေ记ںช记ຍේ,싶෭رúط乌ሪ记рط乌є记ဓชظúย仝µ丝丝ยช记ေळ捩úยرú丝丝丝ยر입ේេេេេړє记ຍ෭رريຍ෭ري乌ሪ记ںช记ຍ෭و₰ช记ේटي乌ሪ记ේេړє记ේេេړ。ේこر纴ේჷ兰ේこو乌捩ú"ذ乌ሪ记ේこرኗ纴෭و"즗记ේេេេこرኗ纴ේ。ේ。ේىور"즗记ේ我ේىويေ记ේ乎:乌رú丝丝兰ේ我ේ我ේрطططຍ捩ú乌입ේ我ේഏ我ේ我ේ感ورຍේ感笙ຍ捩诌ชථرú丝丝ຍේ感ݚሪظຍේெرú р.ຍវช记ຍēرú丝丝丝ຍේეú丝兰ේெي丝丝丝р诌وي丝丝丝ยชظ丝丝兰ේ或طຍ丝丝ú丝ยชطр丝ຍຍ丝丝丝丝ຍ乌ሪេ。úيຍጰرຍ丝рยوي丝丝рኗኗေљ丝丝úي乌ሪظú"즗记ේ扯úኗኗ纴纴ú扯ኗኗ纴иииኗኗú﹔ေេ。捩ኗ乌ሪ记。坐и﹐╮。ඹиيຍŋጰช忐ኗúي乌ሪظ坐и倂입ේჷຍ෭ر乌ሪ记ේេ。ේេ。。。ේេេេ。。ኗ乌ሪ记ේこر纴иএ丝丝乌ේჷط싶෭رúطط싶捩úยបေ记。。ደຍේىر입。ේ感ሪ记úยប纴ຍ෭رúططططр.ںسေ记ຍ෭رú:乌纵记坐ኗ诌رú丝匕Еኗڼ仝ኗú某Єي乌捩ú丝此此此住换₰ي乌ريري乌坐ຍړو₰ي孚ويد丝úии她﹔ሉ此ኗኗေغ丝父ኗسڼو她∭坐ኗúي丝ú"ഹေي丝父úي乌纵ú丝丝Єи仝µ坐Ըي乌ùи丝丝父иʻرኗúи另坐и另丝父úرຍℊ住坐Єúررú₰ჴຸ她介ኗú"	γρρρρρρρρρρρρρρρρρρ贯ךךρρρ贯ρךךρρρρρρρρ贯ρ丳ךך贯ρ贯ρρρρρρρρ

between the limbs (Longbow). Finally, even with relatively simple pseudo-haptic feedback, we can also deliver distinct sensations in multifaceted interactions when the haptics are effectively matched to the user's motion and the visuals rendered (Virtual Bop It). While the broad potential for multisensory pseudo-haptic applications is clear, it is important to note the requirement to fit and calibrate the bracelet to individual users (Experimental Section). We have widely demonstrated these midair interactions in public and private forums to both experienced hapticians and novices alike. Beyond our psychophysical

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findings, positive feedback on the believability of interactions supports our overall hypothesis that no sensory modality alone can lead to compelling feedback, but through combining tactile and visual feedback in a multisensory fashion it is possible to render highly believable substitutive feedback for mid-air interactions with virtual objects.

4. Experimental Section

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In the following section, we present detailed methods necessary to implement our multisensory pseudo-haptic paradigm and replicate our two experiments. First, we introduce the Tasbi haptic bracelet, which enabled us to convey mid-air haptic experiences by providing tactile pseudo-haptic feedback comprising continuous squeeze around the wrist and discrete vibrations. Then we derive the equations needed to control the visual pseudo-haptic C/D manipulation and squeeze forces that were used to render the virtual button throughout both experimental paradigms. Finally, we outline each experiment's protocol, including materials, methods, and statistical analyses.

Tasbi Haptic Bracelet: Tasbi is an advanced multisensory haptic bracelet that incorporates both localized vibration and uniform squeeze feedback.^[15] Vibrations were delivered via six linear resonant actuators (LRA) radially spaced around the wrist. Each LRA was independently controllable through the Syntacts vibration rendering framework,^[29] allowing for the development of expressive feedback patterns. Squeeze feedback was accomplished through a cord tensioning mechanism that had been shown to provide uniform and nominally normal (to the skin) forces of up to 15 N at each contact point around the wrist.^[15] The amount of squeeze force, $F_{squeeze}$, was rendered by means of a closed-loop force controller leveraging a capacitive force sensor located at the base of the tensioner housing.

To ensure that Tasbi delivered consistent squeeze forces across users, all experimental sessions began by fitting and calibrating the bracelet to the user. 3 M Transpore and double-sided mounting tape were used to secure the bracelet to the subject's arm approximately 6 cm behind the ulnar styloid process. Once Tasbi was securely mounted, the subject placed their wrist and Tasbi under a controlled force applicator. The apparatus delivered a sinusoidal force profile sweeping from 0 to 15 N to the top side of Tasbi. Voltage measurements from Tasbi's internal capacitive force sensor were calibrated against the applied force. Following this, subjects removed their arm from the calibrator, and Tasbi was verified to render the full range of 0–15 N to the user's arm.

Virtual Button Formulation for Multisensory Feedback Paradigm: A detailed description of the virtual button presented in Figure 1 and

subsequently used for Experiments 1 and 2 is shown in **Figure 9**. First, a vibration stimulus was rendered through Tasbi's LRAs when the user first contacted the surface of the button. We used an exponentially decaying sinusoidal model^[30] of the form $Ae^{-Bt}sin(2\pi\omega t)$ with parameters of A = 0.125, B = 20, and $\omega = 175$ Hz to generate the contact event waveform. As the user began to press the button, the visual C/D manipulation and squeeze stimuli began to take effect. While C/D ratios are often arbitrarily chosen for simple UI applications, we used a physically based C/D approach that was loosely described in our previous paper^[31] and subsequently formalized by our co-authors in ref. [32] This approach differed from traditional methods in that C/D was not simply a visual scaling from the control to the display, but rather the manifestation of changing the parameters of the button impedance. As such, the button was a simulated second-order system parameterized by a mass *m*, a damping coefficient *b*, a stiffness *k*, and a displacement *x*

$$m\ddot{x} + b\dot{x} + kx = F \tag{1}$$

Interaction forces applied to the button were computed from the displacement of a virtual spring of stiffness k_p connecting the control and display fingertips. Thus, greater penetration depths of x_p resulted in larger forces being applied to the button

$$F = k_p x_p \tag{2}$$

We achieved a desired steady-state C/D by changing the ratio of object stiffness k to proxy hand stiffness k_p . The C/D ratio λ was defined as

$$\lambda = \frac{x_{\text{control}}}{x_{\text{display}}} = \frac{x + x_{\text{p}}}{x}$$
(3)

Choosing to ignore the dynamic contributions of m and b, the force balance equation was simplified to

$$F = k_{\rm p} x_{\rm p} = k x \tag{4}$$

Finally, combining (3) and (4), we defined the C/D ratio λ in terms of the two stiffnesses

$$\lambda = \frac{\frac{F}{k} + \frac{F}{k_{\rm p}}}{\frac{F}{k}} = \frac{k + k_{\rm p}}{k_{\rm p}} \tag{5}$$

Thus, to achieve a desired C/D ratio λ the implementation could compute either k or k_p while holding the other constant. Although either approach was valid, we chose to hold the proxy hand stiffness k_p constant and let the desired C/D ratio drive the calculation of button stiffness k.



Figure 9. Formulation of multisensory pseudo-haptic button. A) The user approaches the virtual button simulated by a mass *m*, stiffness *k*, and damping *b*. The control finger (blue) and display finger (gray) are coupled via a virtual spring of stiffness k_p and are initially collocated. When contact is made, Tasbi's six LRAS C) render a vibration to simulate the event. B) The user begins to push the button downward. Tasbi squeeze force increases proportionally to the button displacement *x*. The control hand continues to track the user's true hand position and orientation, while the display hand remains on the surface of the button. The control-to-display (C/D) ratio is given by the ratio of $x_{control}$ and $x_{display}$. At the end of travel, squeeze reaches its maximum force level, and the C/D discrepancy is most pronounced.

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$$k = k_{\rm p}(\lambda - 1) \tag{6}$$

It is important to note that because we chose to ignore the object mass and damping in the force balance **Equation (1)** the actual C/D ratio fluctuated slightly during dynamic interactions. The amount of C/D error in the dynamic case was minimized by carefully tuning the free variables k_p , m, and b to the anticipated speed of pressing. A more robust method may have chosen to include the object's mass and damping terms in the force balance equation, and/or add a damping term to the proxy finger impedance.

Finally, the amount of squeeze to be applied to the user's wrist was proportional to the simulated button's displacement

$$F_{\text{squeeze}} = k_{\text{s}} x \tag{7}$$

Squeeze rates, k_s , were computed from the maximum desired squeeze stimuli force for a particular trial, $F_{squeeze,max}$, and the button's full displacement length of 35 mm

$$k_{\rm s} = \frac{F_{\rm squeeze,max}}{0.035 \, m} \tag{8}$$

For example, the squeeze stimuli levels $F_{squeeze, max}$ of 3, 7, 11, and 15 N in Experiment 1 gave squeeze rates k_s of 85.7, 200, 314, and 249 N m⁻¹, respectively.

Experiment 1 Overview: Subjects performed the first experiment in a VR environment created in Unity Engine. An Oculus Rift CV1 served as the VR HMD, and Oculus Touch controllers were used to track subjects' hand position and gestures. Within the environment, subjects were presented with two visually identical buttons placed side by side (Figure 2 and S2, Supporting Information). The button on the left represented the physical stiffness and was visuo-spatially aligned with the physical button apparatus (Figure 2) so that when subjects pressed the button in VR, they felt the physical button. The button on the right represented the mid-air stiffness and displayed one of the three haptic rendering methods as detailed in the following sections. Both buttons were 50 mm in diameter and 35 mm tall. Their color was nominally a shade of green but changed to pink if displaced beyond the table surface, indicating to the subject to stop pushing.

Variable Stiffness Button Apparatus: A physical, variable stiffness button (VSB) was constructed and served as the physical stiffness comparison (Figure 2). The VSB was driven by a Maxon RE-25 motor and capstan cable mechanism, like those found in many desktop haptic displays, with a transmission ratio of $0.105 \text{ mm deg}^{-1}$. Closed loop current control was accomplished via an Advanced Motion Controls AB15A100 servo drive and a Quanser QPIDe DAQ interface sampled at 2 kHz on the host PC. After gravity (0.59 N) and kinetic friction (0.18 N) of the button were appropriately compensated for with feed-forward control, a proportionalderivative (PD) position controller allowed for setting the desired stiffness $k_{\rm vsb}$ and damping $b_{\rm vsb}$ of the button. The physical button was able to simulate stiffnesses ranging from 5 to 400 N m⁻¹ before over-drawing current from the power supply. Throughout the experiment, the button damping was computed such that the button was always critically damped: $b_{\rm vsb} = 2/\sqrt{k_{\rm vsb}}m_{\rm vsb}$ where the button mass $m_{\rm vsb}$ was determined to be 0.06 kg.

Experiment 1 Methods: Using the method of adjustments,^[33] Experiment 1 tasked subjects with adjusting the stiffness of the physical button on the left until it was perceptually equivalent to stiffness depicted by the mid-air button on the right. The experiment was divided into 3 experimental blocks defined by the pseudo-haptic rendering condition (unimodal or bimodal) of the mid-air button. Each conditional block tested four pre-defined virtual stiffness levels.

Visual Condition (V): The stiffness of the mid-air button was conveyed only through a unimodal C/D stimulus. The 4 virtual stiffness levels tested were C/D = 3, 4, 5, and 6. The proxy hand stiffness k_v was set to a constant 50 N m⁻¹, and the mass of the button m_b was set to 0.06 kg, equal to the mass of the physical button. Like the physical button, the mid-air button was always critically damped given the desired C/D ratio and resulting computation of the button stiffness k. The choice to critically damp both buttons was made so that subjects would not inadvertently use oscillatory motion to assess stiffness similarities. No tactile cues (squeeze or vibrations) were presented in this condition.

Tactile Condition (T): The stiffness of the mid-air button was conveyed only through a unimodal wrist squeeze stimulus, and the C/D simulation was disabled. In this condition only, both the mid-air button and the physical button were made visually transparent and static (Figure S2E,F, Supporting Information), so that subjects could see their fingers move through the button volumes but could not see the buttons displace. The effect minimized subjects' usage of visual information and forced them to make the comparison based only on what they felt. The squeeze force was proportional to the amount of finger penetration into the button volume, reaching a maximum force at $x_{control} = 35$ mm. The 4 virtual stiffness levels were defined by this maximum squeeze force, $F_{squeeze,max} = 3$, 7, 11, and 15 N. In addition to the squeeze stimulus, vibration cues signaled initial contact with the button and when the button had reached its end of travel. In the context of our experiments, we consider the combination of squeeze and vibration cues collectively as tactile pseudo-haptics.

Tactile-Visual Condition (TV): Virtual stiffness in this condition was conveyed by multisensory pseudo-haptic cues comprising the same tactile and visual pseudo-haptic cues used in the unimodal conditions. The 4 virtual stiffness levels from the unimodal conditions were used and presented congruently (e.g., C/D = 4 with $F_{squeeze,max} = 7$ N, etc.). In this condition, $F_{squeeze}$ was proportional to the C/D button displacement x instead of $x_{control}$ as was necessary in the Tactile condition.

Each conditional block consisted of 64 trials. In each trial, subjects were presented with a mid-air button displaying a fixed virtual stiffness level. The starting stiffness of the physical button was randomly set either near the low end of its rendering range at 25 N m^{-1} or the high end at 375 N m^{-1} . Subjects assessed both buttons and then used the thumb stick of the Oculus Touch controller to change the stiffness of the physical button until it was perceptually equal to the mid-air button. Subjects were allowed to transition between buttons freely but were required to complete the adjustment in 25 s. Subjects were given the option to advance to the next trial once they were confident both buttons were equivalent.

The first 16 trials of each block were practice trials and presented the same virtual stiffness level, which was taken from the center of the tested stiffness ranges (e.g., C/D = 4.5 and/or $F_{squeeze,max} = 9 \text{ N m}^{-1}$). The remaining 48 trials randomly presented one of the 4 test virtual stiffness levels, each repeated 12 times. Subjects were given a short break in between each conditional block. Importantly, the presentation order of the three blocks was randomized between subjects so that each of the 6 possible orders was equally represented. Overall, the experiment lasted approximately 2 h for each subject.

A total of 12 subjects (age: $\{M = 22, SD = 2.9\}$, 8 female) completed the experiment. Subjects were recruited from the Rice University undergraduate and graduate student bodies under Rice University IRB protocol #IRB-FY2020-43 and provided written informed consent. They were compensated 20 USD upon completion of the experiment. Except for a single subject, none had any experience with squeezing haptic displays, and all reported no or very limited experience with VR systems.

Experiment 2 Overview: Subjects performed the second experiment in the same VR environment as Experiment 1; however, for this experiment, the physical variable stiffness button was removed, and both the left and right buttons were rendered through tactile pseudo-haptics (vibration and squeeze) and/or visual pseudo-haptic manipulation (C/D ratio). The size and visual variations of the buttons remained the same as described in Experiment 1 Overview.

Experiment 2 Methods: Using the method of constant stimuli^[33] and a two-alternative forced-choice (2AFC) procedure, the experiment tasked subjects with selecting the stiffer of two mid-air buttons. Each of the three mid-air button conditions (V, T, and TV) was presented in a separate experimental block. Each block consisted of 8 practice trials and 220 test trials. In each trial, two visually identical buttons were presented on the left



and right, and subjects were allowed either five seconds or two presses of each button, whichever came first, to decide on which button was the hardest or stiffest to press. Subjects were instructed to alternate between the buttons and to make their selection as soon as they were confident. Subjects made their selection by moving the thumb stick on the Oculus controller to the left or right. One button, the standard, presented the same stimulus in every trial and was randomized to appear on either the left or right side an equal number of times. The other button, the comparison, displayed one of 11 virtual stiffness levels: 5 below the standard level, 5 above the standard level, and the standard level itself. Each comparison level was repeated 20 times, and the presentation order was randomized for each subject.

The virtual stiffness levels for the T and V conditions were derived from the results of Experiment 1 by using the group mean estimated stiffness as a proxy to perceptually match the squeeze and C/D levels to each other. Noting the similarities between the first 3 levels of the T and V conditions in Experiment 1, we chose to test a proxy stiffness range of $50-150 \text{ Nm}^{-1}$. Thus, the chosen comparison max squeeze levels for the T condition in this experiment were 3.0, 3.8, 4.6, 5.4, 6.2, 7.0, 7.8, 8.6, 9.4, 10.2, 11 N with a standard level of 7.0 N. The comparison C/D levels for the visual condition were 3.0, 3.2, 3.4, 3.6, 3.8, 4.0, 4.2, 4.4, 4.6, 4.8, 5.0 with a standard level of 4.0 (Figure S1, Supporting Information). The TV condition presented the unimodal levels congruently. Subjects were given a 5 min break in between condition blocks, and the presentation order of blocks was randomized between subjects in a counterbalanced manner. The experiment lasted 2 h for each subject.

Twelve new subjects were recruited for Experiment 2 (age: {M = 25, SD = 4.8}, 3 female). One subject was excluded from all analyses for failing to follow the provided instructions. Subjects were pooled from the Rice University undergraduate and graduate student bodies under Rice University IRB protocol #IRB-FY2020-43 and provided written informed consent. They were compensated 20 USD upon completion of the experiment. Only one subject reported any experience with squeezing haptic displays, and none had significant prior experience with virtual reality devices.

Statistical Analysis: MATLAB (version R2020A) statistical packages were used to analyze the data and perform all statistical tests. For Experiment 1, a two-way repeated measures ANOVA was used to compare differences in subject mean stiffness estimates across conditions and levels. Two-sided p values lower than .05 indicated significant differences. Any sphericity violations found though Mauchly's test were treated with a Huynh-Feldt correction. Post hoc analysis compared the TV-T and TV-V conditions, separately using similar two-way repeated measures ANOVAs. The same full procedure was carried out on the measure of subject residual errors. The measures of subject slope, fit, and squared residuals were compared between the TV-T and TV-V conditions using pair-sample t-tests with a Bonferroni correction (i.e., significance indicated by p values lower than .025 for two comparisons). A subject was considered an outlier in a condition if their mean stiffness response in two or more levels was more than 1.5 interquartile ranges above or below the upper or lower quartile range. One subject was found to be an outlier in the V condition, and another in the TV condition, as shown in Figure 3. The outlier data for slope, fit, and residual error summarized in Figure 3 were replaced with the group mean of the respective condition.

In Experiment 2, separate one-way repeated measures ANOVAs (with Huynh–Feldt corrections, if needed) were used to compare differences in JND, PSE, percent correct, and residual errors across condition. Pairwise comparisons between all three conditions were made using Tukey's honestly significant difference procedure. There were no outliers for Experiment 2.

Supporting Information

Supporting Information is available from the Wiley Online Library or from the author.

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Conflict of Interest

The authors declare no conflict of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Keywords

augmented reality, bracelet, haptic interaction, haptics, virtual reality, wearables

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