

Prescribing laughter to increase well-being in healthy adults: An
exploratory mixed methods feasibility study of the Laughie

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Abstract

Introduction: Calls for a practical laughter prescription have been made by the medical community. This research developed the Laughie and evaluated its impact to elicit laughter and increase well-being in healthy adults. The Laughie is a user-created one minute recording of the user's laughter, operated by re-playing it while laughing simultaneously.

Methods: A mixed methods preliminary feasibility study was conducted between March and May 2018. Twenty-one participants aged 25 to 93 ($x=51$, $SD=20$) created a Laughie and were instructed to laugh with it three times a day for seven days, documenting each trial. Well-being was measured prior to and post-intervention using the World Health Organization (WHO five-item) well-being index. Interviews were analysed using thematic analysis. Evaluation considered the Feasibility, Reach-out, Acceptability, Maintenance, Efficacy, Implementation and Tailorability (FRAME-IT) of the Laughie.

Results: The Laughie elicited laughter for most of the one minute in 89% of 420 Laughie trials; immediate well-being increased in 70% of them. Absolute overall WHO well-being scores increased post-intervention by 16%. Laughie evaluation using FRAME-IT showed the Laughie was feasible, acceptable, and tailorable. Four smart laughter techniques that facilitated maintenance/usage were identified.

Conclusions: The Laughie was feasible, enjoyable, and effective as a laughter prescription in eliciting laughter. Fourteen participants reported absolute well-being

increases of 10% or more. Ten participants found their laughter self-contagious. Smart laughter (laughing in a smart way for a smart reason on a smartphone) is a convenient way to harness the benefits of laughter. FRAME-IT is proposed as a practical planning and evaluation framework.

1. Introduction

An integrative approach to complementary medicine, emphasising self-care, and person-centred health and well-being, is supported by the World Health Organisation (WHO) [1, 2]. Laughter and humour interventions draw on research signalling a range of health benefits of humour-induced [3, 4], and self-induced [5] laughter on psychophysiology. However a systematic review [6] exploring the impact of these interventions on well-being, i.e. feeling cheerful, relaxed, active, rested, and interested in life [7], found insufficient evidence as individual laughter was not explicitly measured and intervention elements (e.g. physical activities, humour, and group interactions) were confounding. Gathering robust evidence for laughter's impact on well-being can build a knowledge base for laughter's benefits. This can inform its application in integrative medicine and support health professionals in best prescribing laughter as a low-risk, no-cost, and naturally beneficial intervention [8, 9].

The Laughie was therefore developed to investigate the impact of laughter on well-being, and to answer calls from the medical community for a practical laughter prescription [8, 9]. It is conceived to elicit laughter and increase well-being, and doubles as a measurement tool to track individual laughter (both initial parameters and as a timer). The Laughie is a one-minute self-induced laughter recording on the user's smartphone. It is operated by the user laughing simultaneously with the one minute recording.

Gelotologists tend to view laughter as a social emotion [10, 11] or more specifically, as a reaction to humour [12]. Nevertheless, Fry [3] saw laughter as affecting the ‘whole physical being’ (p. 114), and Weeks [13] considers solitary laughter ‘a significant, complex behaviour’ (p. 76); both views inspired the Laughie conceptualisation as a holistic solo laughter tool. Because social laughter is not necessary for Laughie usage there is more autonomy for self-care [1]. This enables convenience, and is also relevant for the disabled and those with long-term health conditions who are significantly more likely to report loneliness [14]. The Laughie is humour-independent to explore laughter without the confounding influence of humour [15], and in recognition that not all humour styles are positive [16].

The Laughie was informed by findings that positive psychophysiological changes due to laughter can increase well-being [17]; this can drive motivation [18], and support health self-management [19]. A self-created Laughie also builds personal efficacy as the user knows that the prescription is achievable [19]. Laughie duration was inspired by the finding that one minute of self-induced laughter significantly increased positive affect in groups of adults unprompted by humorous stimuli [20]. While the contagious properties of laughter are well known [10], to the best of our knowledge the Laughie explores the potential self-contagious effects of listening to one’s own pre-recorded laughter for the first time. Laughie laughter is joyful, happy and cheerful. Joyful laughter is considered playful and primal [21] and does not need to rely on cognitive resources for the ‘funniness’ that distinguishes mirthful humour-associated laughter [12].

The Laughie was evaluated for Feasibility, Reach-out, Acceptability, Maintenance, Efficacy, Implementation, and Tailorability (FRAME-IT); an approach developed specifically for evaluating the usability of the Laughie in this study. Existing evaluation

frameworks were considered unsuited for evaluating an early-stage laughter prescription as they are more concerned with implementation and dissemination than functionality, and none were found to include feasibility, acceptability and tailorability constructs. The Reach, Efficacy, Adoption, Implementation, Maintenance (RE-AIM) [22] framework, informed the development of FRAME-IT to enable elements essential for future intervention scale-up to be considered at an early stage.

The ‘amount’ of laughter needed each day is unknown; suggestions of 15 to 20 minutes a day have been made [9] but may be impractical. In the interest of user convenience, the impact of prescribing the one minute Laughie three times a day was explored. Research aims of this early-stage intervention were to: (1) evaluate the Laughie as a laughter prescription to elicit laughter; (2) investigate the impact of the Laughie on well-being; and (3) trial FRAME-IT as a planning and evaluation framework.

2. Methods

2.1. Design

The intervention, conducted between March and May 2018, used a pragmatic mixed methods research methodology with in-depth interviewing to ascertain preliminary feasibility [23]; a small convenience sample with no control group was therefore practical. Data was gathered and contextualised using five discrete but complementary measures deployed pre, during, and post intervention. Intervention design and planning was guided by pre-defined FRAME-IT constructs presented in Table 1.

Table 1. Research planning and evaluation using FRAME-IT

Constructs	Research-focused construct definition	Measures used for evaluation
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Feasibility	Laughie creation; technical ease	2, 5
Reach-out	Potential users; populations	1, 5
Acceptability	Overall experience; solo laughter	2, 5
Maintenance	Laughie usage: fidelity, techniques, motivation	2, 3, 4, 5
Efficacy	Laughie ability to elicit laughter	3, 5
	Laughie ability to increase well-being	3, 4, 5
Implementation	Support; dissemination	5
Tailorability	Customization (design); personalisation (usage)	5

Note. 1. Demographic checklists; 2. Creation checklists; 3. Laughie checklists; 4. WHO well-being index [24]; 5. Interviews.

2.2. Ethics

Research complied with the British Psychological Society [25] ethical guidelines, and was approved by the University of Derby ethics committee on March 3, 2018.

2.3. Participants

Convenience and snowball sampling was used to recruit 22 (6 male) participants, living in Monaco and France and known or personally recommended to the Monaco-based researcher, by word of mouth and email. Twenty-one (6 male), aged 25 to 93 ($x = 51$, $SD = 20$), completed the intervention. Participants were eligible if they were aged 18+, in good health and with no impeding conditions (e.g. deafness), fluent in English, and a smartphone owner.

2.4. Measures

Five self-report measures, mapped to FRAME-IT constructs in Table 1, were identified:

- (1) Demographic checklists including estimated daily laughter frequency
- (2) Creation checklists appraising Laughie creation (i.e. the initial user-created recording) and motivation to test

- (3) Laughie checklists tracking fidelity (time laughed), adaptation, and immediate well-being after each trial (3 x a day, for 7 days, i.e. 21 trials per participant) using three five-point Likert Scale statements: 'I laughed for most of the time during the Laughie', 'I laughed in a similar way to the Laughie', and 'I felt better afterwards, e.g. more cheerful'
- (4) WHO (five) well-being indexes [24] to capture well-being perceptions in the two weeks prior to, and seven days during the intervention using five statements e.g. 'I have felt cheerful and in good spirits', and 'I woke up feeling fresh and rested'
- (5) Interview questions (open-ended) to explore experiences including 'did you enjoy using the Laughie?', 'was it effective in making you laugh?', and 'how could it be improved'?

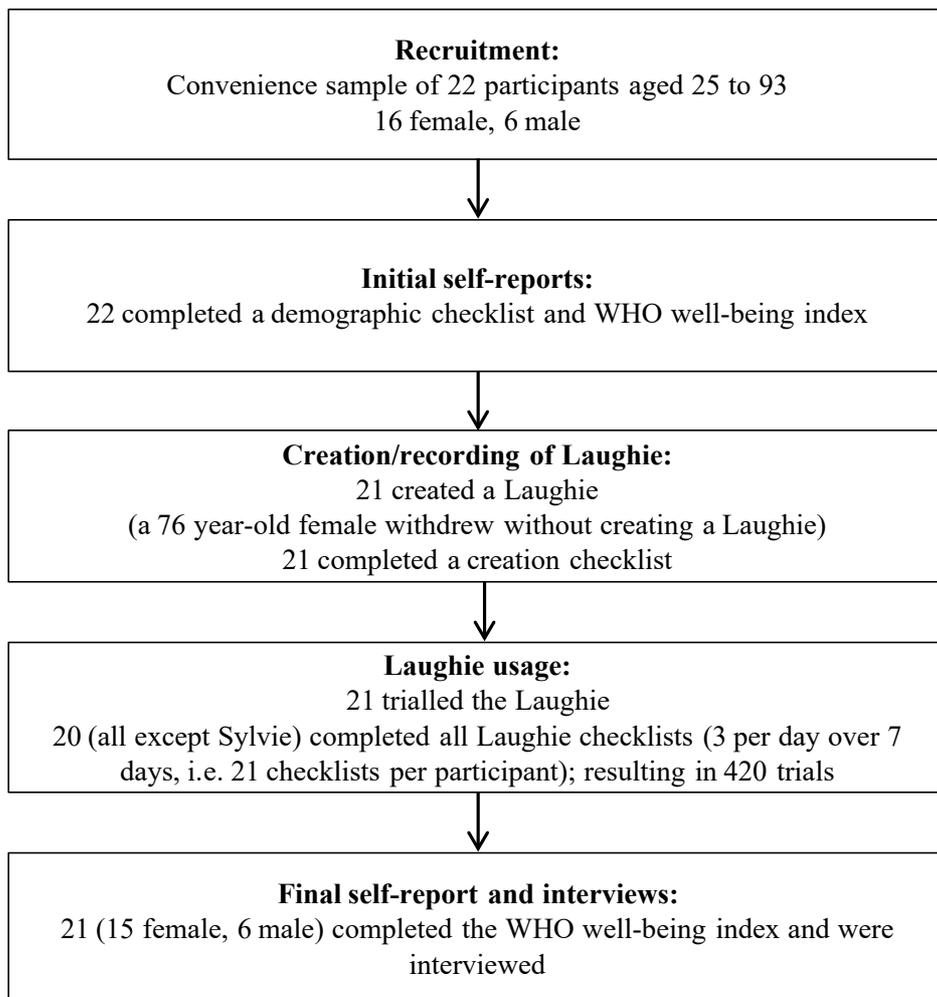
2.5. Procedure

Fifty potential participants were contacted individually by word of mouth or email, and given information sheets, and consent forms if requested. Twenty-two agreed to participate and completed consent forms. In individual meetings with the researcher they chose a pseudonym and completed the demographic checklist and well-being index. Figure 1 tracks intervention participation.

Solo laughter was presented as an autonomous way of laughing without the need for a social or external humour stimulus. The Laughie recording was explained as a laughter prescription tool, with the objective being to 'laugh with your Laughie'. A video 'Laughing alone with Dr. Kataria' [26] was shown and techniques used by Dr. Kataria to elicit laughter were discussed: 'fake it until you make it' and 'laugh for no reason' [6]. Laughie laughter was described as joyful, playful, happy, and cheerful; repetitions of 'ha', 'he', or 'ho', were suggested to trigger laughter and enable breaks between laughter bouts.

Example Laughies were played and the researcher demonstrated usage by laughing with hers for one minute.

Figure 1. Flowchart of intervention participation



When participants felt ready to laugh they recorded their laughter on their smartphone, with the researcher co-recording, smiling, and signalling to stop after one minute. Participants then accessed their Laughie and completed the creation checklist. Instructions to trial the Laughie were to: (1) simultaneously listen to and laugh with their Laughie for the full minute at a convenient time in the morning, afternoon and evening for seven days; (2) complete the Laughie checklists (distributed) immediately after each

Laughie; (3) explore ways to enjoy their Laughie including using it with others; (4) listen to their Laughie if they felt unable to laugh for the entire minute; (5) recuperate missed trials to complete seven for each time of day.

In individual post-intervention meetings participants completed the WHO well-being index [24] and were interviewed and debriefed. Interviews averaging 30 minutes (range: 15 – 50 min) were recorded using a smartphone.

2.6. Data analysis

Quantitative self-report measures were summarised and relative and absolute differences in overall pre- and post-intervention WHO (five) well-being scores were calculated. As monitoring recommendations [24] specify that a 10% absolute difference in score indicates a significant change, minimal explorational inferential analysis using paired *t*-tests was conducted. Likert data, treated as parametric [27], was analysed. Correlational analysis to determine Pearson's *r* was conducted using data from the 420 Laughie checklists to explore relationships between individual laughter duration and immediate well-being.

Interviews ($n = 21$) were transcribed verbatim and analysed using thematic analysis [28]. Techniques proposed by Saldaña [29] supported analysis: 1,318 first impression phrases 'decoded' or interpreted text, to 'encode' or identify 38 codes; 'subcodes' facilitated data differentiation within codes. A deductive approach allocated codes to 17 research-relevant categories. These were reduced to 15 sub-themes within seven FRAME-IT driven themes. Data triangulation probed consistency between quantitative self-reports and interview feedback to identify and potentially resolve data contradictions. Discussions between the researcher and supervisor ensured the validity and rigour of data analysis. Data synthesis reflected individual and overall patterns.

3. Results

Twenty-one participants created a Laughie, and used it for one minute three times per day for one week. Results are presented within the FRAME-IT driven themes and sub-themes, summarised in Table 2. This approach was chosen to transcend the habitual binary boundaries of mixed methods research [30].

Table 2. Interview themes and sub-themes

	FRAME-IT based themes	Sub-themes
F	Feasible usage	1.1. Achievable Laughie creation 1.2. Technical ease
R	Broad user potential	2.1. Healthy children and adults 2.2. Lonely and depressed
A	Enthusiastic but variable acceptability	3.1. Solo laughter valued 3.2. Circumstance-driven variation
M	Individualised maintenance	4.1. Creative usage approaches 4.2. Motivation to continue
E	Effective and serendipitous impact	5.1. Laughter elicited in all 5.2. Increased well-being 5.3. Beneficial ripple effects
I	Implementation opportunities	6.1. Ameliorate demonstration 6.2. Explore dissemination
T	Ease of tailorability	7.1. Customisation if desired 7.2. Personalised usage for all

3.1. Feasible usage

As each Laughie is user-created, creating a Laughie is fundamental for feasible usage. This was achievable and Laughie usage on the smartphone was perceived as practical.

3.1.1. Achievable Laughie creation

Laughie creation was seen as challenging. Individual mentoring of 30 to 60 minutes (during which the Laughie was demonstrated, and solo laughter was discussed) was required before participants felt ready to record their own Laughie. A 76-year-old female made two short attempts but felt uncomfortable her laughter was not ‘genuine’ and withdrew. The others all recorded their Laughie. Ten used internal humour to help them laugh, ignoring the technique to ‘laugh for no reason’. All reported being motivated to use the Laughie. Laughie creation served as a mastery experience: as John (35) said ‘*it’s important to have the mentor*’ to ‘*understand it*’.

The first one you’re like a little bit ashamed and you’re like a little bit stressed... the fact that you did it first was nice (Clownfish, 25)

That was the hardest part because you don’t know what to expect. You don’t know if you are going to make it through the 60 seconds (Mika, 54)

3.1.2. Technical ease

All participants found the Laughie convenient and easy to use on the smartphone. The immediacy of access was also appreciated:

Just knowing you can have it when you want is already a medicine (SmileyComet, 28)

3.2. Broad user potential

Participants were in overall good health. Sylvie (93) and Octopussy (58) reported pain. Baseline well-being scores indicated variation: six reported scores below 13 (i.e. below

50%) ‘an indication for testing for depression’ [24], while four had well-being scores of 80% or above (Table 3). Daily laughter variation was also reported: most participants laughed 4-10 times a day, four 1-3 times, and four more than 15 times. Participants perceived the Laughie as suitable for most ages, and many highlighted it as a potential treatment for depression or loneliness.

3.2.1. Healthy children and adults

Suggestions for general Laughie usage ranged from encouraging emotional expression in older adults, to developing relaxation in children. Age was not seen as a barrier for Laughie usage; John (35) proposed ‘7 to 97’.

There is no age for the Laughie... people who are stressed, anxious or unsure of themselves (Lemonade, 25)

Forties, fifties, you know the burnout period, men turning crazy at 40s... family problems, feeling alone, finding a right person, work conditions (Jean-Paul, 32)

I’m pretty sure that it could be big fun for children, and for seniors that are disposing freely with their time (Roquelau1, 69)

3.2.2. Lonely and depressed

The Laughie was perceived as a natural treatment for loneliness and depression, particularly for mild depression by nine participants. All six participants with poor baseline well-being reported scores of 50% or above post-intervention (Table 3). Sylvie (93) sometimes felt ‘*very lonely*’ but said usage encouraged her to laugh while watching the television on her own, something she never ‘*normally*’ did. Several participants reported feeling ‘*not alone*’ with their Laughie.

Such a treatment could be better than prescribing pills... a Laughie is something so natural (SmileyComet, 28)

I'd definitely recommend it to people who are experiencing something similar to depression, or depression (Sianaa, 29)

3.3. Enthusiastic but variable acceptability

The Laughie experience was acceptable but also impacted by fluctuating individual and external circumstances.

3.3.1. Solo laughter valued

Although it was considered '*unusual*' solo laughter was widely accepted. As John (35) said: '*why not share something with yourself as well?*' Many savoured a pleasurable new activity they could enjoy alone, including a husband and wife using it in parallel, and most were enthusiastic about the Laughie experience. Marie (54) found it '*really positive*', Jean-Paul (32) '*useful and conclusive*', and John (35) '*a technique that is very important for people to get to know*'. SmileyComet (28) enjoyed it as '*a moment for myself*'. Some appreciated what they perceived as a different laughter quality with the Laughie: Sylvie (93) said it was '*deeper*' than her social laughter.

I want to do it alone with myself only, and it's helped me. It's my exercise (Marie, 54)

The fact that I could do it alone helped me a lot. I really let rip (Callas, 57)

3.3.2. Circumstance-driven variation

Moods, attitudes, and external circumstances resulted in varied inter- and intra-individual acceptability. Sylvie (93) felt '*self-conscious*' initially, but after practice it '*felt good*'.

Mika (54) found the Laughie fun initially, but less as the novelty faded. Octopussy (58) found it counter-productive when she had a headache; Josephine (64) when under '*a lot of pressure*'. Lemoncello (59) found the Laughie '*brilliant*' in town, but '*a chore*' when out in nature. Roquelau1 (69) needed '*peace of mind*' to benefit from it; this was difficult during a busy office week and explained his being 'unsure' about feeling better after most Laughie trials. Callas (57) found it '*much more difficult*' when feeling down. Moose (65) had initial high expectations, but '*felt worse*' when they fell short. Usage in the presence of others and at work could be problematic:

Sometimes it was finding the place and the time even though it does only take a minute
(Josephine, 64)

She (her maid) would think I'm stark staring mad if I started laughing... for somebody to suddenly start laughing you think well something's going wrong (Sylvie, 93)

3.4. Individualised maintenance

Fidelity to testing instructions was largely observed. Most participants laughed for the majority of the one minute. Most explored ways to enjoy their Laughie, including experimenting with their laughter as reflected in their agreeing to 'I laughed in a similar way' in only 55% of the 420 trials. Some participants created new Laughies; only Hervé-Pierre (76) trialled the new recording.

3.4.1. Creative usage approaches

Participants added visual, gestural, mental, and social elements to facilitate laughter and increase enjoyment. Lemoncello (59) found observing facial physiology in a mirror

helpful; Clownfish (25) found a mirror *'funny'*, *'because you see your face just like expand'*. Several participants enjoyed moving with their Laughie, SmileyStar (29) said hand gestures were motivating *'it felt a bit like go on, do it; you can do this'*. Six participants purposefully added internal humour by remembering funny events or images to increase enjoyment, and several participants enjoyed how their laughter unintentionally resulted in humorous thoughts. Two relied fully on humorous incidents, or jokes, to laugh. Nicole (76) felt she needed to access external humour on her computer to trigger laughter before playing her Laughie.

A few experimented with sharing their Laughie and found it enjoyable, like a *'game'* for mother and daughter Octopussy (58) and Clownfish (25). Locations such as a crowded restaurant and in the car could be amusing. Participants reported effort to train their laughter to sound inspirational and natural, which was widely perceived to be more effective. John (35) said *'it becomes natural, it's a training'*. Bob (57) enjoyed being *'a perfect actor'*. Several also trained a playful attitude. Participants ignored suggestions to *'laugh for no reason'*, giving a range of reasons including for joy, happiness, humour, including as Clownfish (25) said *'making fun of my own self'*, as a medicine, meditation, for the *'pleasure in laughing'*, to relax, as Hervé-Pierre (76) said to *'evacuate things'*, for exercise, for energy, and to disconnect. Deeper meanings, some relating to self-discovery, were also voiced: SmileyComet (28) saw it as *'feeding your soul'*.

You focus on it and by just doing it your attention is taken away from what you're clinging on to... It's like removing barnacles (SmileyComet, 28)

You try to bring a bit of joy into your mind... just let open the door... you laugh at life, you laugh at your problems, so it's gym for the soul (Bob, 57)

I found myself before each Laughie session writing a mental list of lovely... or amusing things that had happened, maybe in the last hour or in the last few days, to inspire me to laugh to my Laughie (Callas, 57)

3.4.2. Motivation to continue

Without the obligation to test three times a day most participants envisaged usage when needed, or once or twice a day at their preferred times. For example SmileyStar (29) enjoyed the morning Laughie most, and Gigi (63) the least. Gigi (63) felt motivated by a ‘*duty to do it and... to share with other people*’. Only Moose (65), who did not explore ways to enjoy her Laughie, ruled out future usage.

I’m going to continue doing it... for the sports effects, and then I feel also for maybe the emotion that you feel just afterwards (Clownfish, 25)

I’d definitely continue using it because it really helped me gain energy and mostly relieve stress, so I felt pretty good about it (Sianaa, 29)

3.5. Effective and serendipitous impact

Laughie checklists completed by all participants except Sylvie (93) showed the Laughie was effective in eliciting laughter and increasing immediate well-being. Comparison of WHO well-being scores showed overall increased well-being post-intervention. A range of unexpected benefits were also reported.

3.5.1. Laughter elicited in all

Participants agreed to ‘I laughed for most of the time’ in 89% of 420 Laughie trials (strongly agreeing in 54%); they were unsure in 6%, and disagreed in 5%. Ten described

their Laughie as contagious or self-contagious. All but two participants relayed Mika's (54) sentiment that the Laughie made it '*much easier*' to laugh. Moose (65) and Lemonade (25) did not, however they also did not recognize their laughter. Moose said it '*sounded foreign*' and Lemonade that it made her '*ill at ease*'. Natural laughter triggered laughter: Jean-Paul (32) only really laughed in the last 20 to 30 seconds when his Laughie sounded '*more natural*'. Hervé-Pierre (76) preferred his '*more natural*' Laughie. When Lemoncello (59) '*gained confidence*' she recorded a '*highly infectious*' Laughie. The Laughie could be a powerful laughter trigger:

Yes, totally self-contagious; yes pushing me to get to it (John, 35)

Sometimes I was laughing so much and I was like oh my God, what, it's just funny just to hear my laughter (Octopussy, 58)

3.5.2. Increased well-being

Participant average absolute WHO well-being scores increased by 16% from baseline to post-intervention (Table 3). The Laughie prescription resulted in statistically significant well-being increases from baseline ($M = 14.95$, $SD = 4.07$) to post-intervention ($M = 19.05$, $SD = 3.19$): $t(20) = 5.21$, $p < 0.0001$. Absolute increases of well-being scores of 10% or higher, indicating a significant change [24], were reported by two thirds of the sample ($n = 14$). The other third included 5 participants with non-significant increases, (i.e. below 10%), one with no change, and one with decreased well-being.

The 20 participants who completed the Laughie checklists agreed to 'I felt better, e.g. more cheerful' immediately after 70% of 420 Laughie trials (strongly agreeing in 25%); they were unsure in 22%, and disagreed in 8%. Analysis of the relationship between laughter duration and immediate well-being suggested strong correlation with a large

effect size ($r > .5$) in the majority of participants. A negative correlation was seen in Moose and Josephine. Although Moose (65) did not enjoy the Laughie experience, she reported increased overall post-intervention WHO well-being. Josephine (64) enjoyed the Laughie 'at times', but had a very 'stressful' work week and reported a decrease in overall well-being.

It helped to just have a regular positive vibe during my schedule... it was a harsh week
(Clownfish, 25)

Having done three times a day I could feel that I was more relaxed at the end of the day, easier to go to sleep, to fall asleep... mentally I knew that I was in a better mood the day after (Jean-Paul, 32)

Table 3. Overall pre- and post-intervention WHO well-being scores by participant

Participants (<i>n</i> = 21)		WHO Well-being Scores ¹					
Pseudonyms	Age	Baseline		Post-intervention		Difference %	
		Raw Score ²	Percentage Score ³	Raw Score ²	Percentage Score ³	Relative	Absolute ⁴
Clownfish ⁵	25	13	52%	19	76%	46%	24%
Lemonade	25	12	48%	18	72%	50%	24%
SmileyComet ⁶	28	18	72%	20	80%	11%	8%
Bebopalula	29	14	56%	15	60%	7%	4%
Sianaa ⁷	29	17	68%	23	92%	35%	24%
SmileyStar ⁶	29	20	80%	22	88%	10%	8%
Jean-Paul ⁷	32	11	44%	19	76%	73%	32%
John ⁷	35	17	68%	23	92%	35%	24%
Marie ⁸	54	20	80%	22	88%	10%	8%
Mika	54	23	92%	23	92%	0%	0%
Bob ⁷	57	9	36%	21	84%	133%	48%
Callas	57	15	60%	18	72%	20%	12%
Octopussy ⁵	58	13	52%	17	68%	31%	16%
Lemoncello	59	18	72%	22	88%	22%	16%
Gigi	63	9	36%	21	84%	133%	48%
Josephine ⁹	64	16	64%	13	52%	-19%	-12%
Moose ⁹	65	12	48%	15	60%	25%	12%
Roquelau ^{1 7, 8}	69	20	80%	21	84%	5%	4%
Hervé-Pierre ⁷	76	14	56%	17	68%	21%	12%
Nicole	76	15	60%	18	72%	20%	12%
Sylvie	93	8	32%	13	52%	63%	20%
Mean (M)	51	14.95	60%	19.05	76%	27%	16%

Note. 1. WHO Well-being index [24]. 2. Raw scores range from 0 (worst) to 25 (best) [24]. 3. Raw scores multiplied by four to obtain a percentage score with 100 as best. 4. A 10% absolute difference indicates a significant change (ref. John Ware, 1995) as cited in [24]. 5. Daughter and mother. 6. Sisters. 7. Male. 8. Husband and wife. 9. Colleagues.

Analysis of WHO well-being scores by statement from baseline to post-intervention (Table 4) showed the highest increases in ‘I woke up feeling fresh and rested’ (20% in absolute terms). However these increases were reported by less than half the participants (*n* = 8), but notably by five of the six participants with baseline scores under 50%. The second highest increases, reported by most participants (*n* = 14) were in feeling cheerful

and in good spirits (18% in absolute terms). Twelve participants reported increases in feeling calm and relaxed; eight felt more active and vigorous.

Table 4. Overall pre- and post-intervention WHO well-being scores by statement

Five WHO well-being statements ¹	WHO Well-being Scores ¹ (n = 21)					
	Baseline		Post-intervention		Difference %	
	Raw Score ²	Percentage Score ³	Raw Score ²	Percentage Score ³	Relative	Absolute ⁴
I have felt cheerful and in good spirits	67	64%	86	82%	28%	18%
I have felt calm and relaxed	64	61%	81	77%	27%	16%
I have felt active and vigorous	61	58%	77	73%	26%	15%
I woke up feeling fresh and rested	46	44%	67	64%	46%	20%
My daily life filled has been with things that interest me	76	72%	89	85%	17%	13%
Mean (M)	63	60%	80	76%	27%	16%

Note. 1. WHO Well-being index [24]. 2. Raw scores per statement ranged from 0 (worst) to 105 (best); $105 = n * 5$. 3. The percentage of the raw score to the best possible score (i.e. 105). 4. A 10% absolute difference indicates a significant change (ref. John Ware, 1995) as cited in [24].

3.5.3. Beneficial ripple effects

Participants reported feeling more open to laughter, humour and smiling during the week. They laughed and joked more socially, including participants that reported infrequent daily laughter at baseline. This potentially contextualised some results, for instance Moose (65) stated *'the Laughie itself didn't make me laugh but the concept made me laugh'*.

The Laughie gave a sense of companionship: SmileyComet (28) said *'it makes you feel surrounded... included, and supported'*, and John (35) felt *'not alone'*. The Laughie

ignited humour: Gigi (63) revealed funny memories '*came to my mind*' as she laughed, a sentiment voiced by others who did not intend to use humour. It also diluted negative emotions. Bebopalula (29) felt '*less anxious*' and Callas (57) said it helped her laugh at herself, diffusing pride. John (35) saw it as '*the solution*' to mood regulation. Benefits similar to physical exercise were also reported: Marie (54) felt more '*toned*', and Clownfish (25) was '*shocked*' at the impact on her abdominals. For Hervé-Pierre (76) it had '*the same effects*' as exercise. The Laughie left a strong impression on some: John (35) spoke of feeling '*euphoria*', '*satisfaction*' and '*fulfilment*' adding '*I wouldn't say like an orgasm... but it's close*'. Callas (57) saw it as '*a change of lifestyle*'.

I got angry once with a friend of mine, and so I decided to use the Laughie at this time and it did help me relieve most of the anger (Sianna, 29)

It really helped connect me to my soul, you know to my different emotions and... re-discover a part of myself as well (John, 35)

(The Laughie) balances, and therefore I think you feel more resilient... not weighed down by all the things that are going on (Nicole, 76)

3.6. Implementation opportunities

Ways to improve the initial Laughie demonstration, and a range of dissemination options, were suggested.

3.6.1. Ameliorate demonstration

Two techniques proposed to elicit laughter were unhelpful: fake-sounding recorded laughter was not enjoyable and it did not trigger laughter, and participants ignored the technique to 'laugh for no reason'. Several participants suggested time to practice the Laughie prior to recording. Nicole (76), who relied on external humour to trigger laughter,

said catching her natural laughter would be helpful and a *'big part of it'*. Bebopalula (29) voiced a need for Laughie support videos; others saw benefits in group demonstration.

The important thing in the Laughie is to make it sincere and as good as possible. If you miss it the first time... it's not easy to do it (Jean-Paul, 32)

(Initial demonstration) *As a group, because you get each other laughing as well, and it might come out more natural* (Josephine, 64)

3.6.2. Explore dissemination

Suggestions for dissemination included adding a Laughie to daily routines, or before or after mealtimes, and brushing teeth; enabling a Laughie room within companies; and including it in exercise routines. Hervé-Pierre (76) saw the potential of the Laughie as a sport, saying *'it's like an exercise'*; others shared this viewpoint.

I'm more of an exercise person in the morning and so I think in the morning it's more your jump start, and the Laughie is part of this routine (SmileyStar, 29)

An alternative way of practicing sport, especially for older people sitting all day long... one Laughie a day could make a difference (Jean-Paul, 32)

3.7. Ease of tailorability

A range of suggestions to tailor Laughie design, and personalise usage to individual needs and preferences, were made.

3.7.1. Customisation if desired

A video element was suggested by some to facilitate laughter and increase enjoyment; others thought audio-only better. Jean-Paul (32) felt seeing himself laughing naturally would be the *'best thing'* to help trigger laughter. Reduced length was also suggested.

I think one minute is the most time, the maximum, yes. But if it's less, perhaps it's better
(Bebopalula, 29)

I loved the fact that it was audio... I actually think it's in a way more creative... you can imagine anything you want (Callas, 57)

It would be nice to have a video that went with it... I really believe in the visual (Nicole, 76)

3.7.2. Personalised usage for all

Participants emphasized the importance of flexible personalisation according to needs, preferences and circumstances. Creative approaches (Section 3.4.1) facilitated laughter and made it more enjoyable, especially for those who found the Laughie less contagious. Many reported a close connection to their own laughter: Callas (57) viewed it as *'custom-made for myself'*; however some suggested using multiple Laughies, their own and others, even a *'baby Laughie'*, for variety and enjoyment.

Everyone must have a different interaction with the Laughie that's their own recipe maybe which is nice because it gives you reigns on how to use it (SmileyComet, 28)

I thought if I have more Laughies, (my) own Laughies, or different Laughies (from) somebody else, perhaps I laugh more (Bebopalula, 29)

Despite initial discomfort, Lemonade (25) was able to find ways to enjoy her Laughie. As she said *'smart laughing is to make a sort of exercise that makes you happy'*.

4. Discussion

The FRAME-IT evaluation suggested participants had positive experiences using the Laughie three times a day as a laughter prescription tool to elicit laughter and increase well-being. Four techniques were associated with efficacious Laughie usage and maintenance (Figure 2). The findings also offer some clarity on the ‘enigma of solitary laughter’ [13] in that laughter appears to benefit personal development as well as social bonding.

4.1. Feasibility

Feasibility was evaluated, and established, by observing and questioning the ease with which participants recorded and used their Laughie on a smartphone. Albeit challenging, all except one were willing and able to record their Laughie. Creation serves as a mastery experience and demonstrates to both user and prescriber that it is achievable; a challenging creation experience can build self-efficacy and reassure the user of their capabilities should they feel discouraged [19].

4.2. Reach-out

Laughie reach-out, i.e. the populations it may reach out to and benefit, was evaluated according to sample demographics as being potentially suitable for healthy adults aged 25 to 93 with baseline WHO well-being scores of 8 to 23. Participant perceptions extended potential reach-out to children and populations suffering from mild depression, and loneliness. Because the Laughie benefitted sleep, and increased well-being in all six with low baseline scores, it merits testing for mild depression. Previous research has shown that sleep disorders and depression improve with laughter [31]. As laughter analysis can diagnose depression [32] the Laughie may potentially treat and track

depression. As some participants reported feeling less alone with their Laughie, and it encouraged more social laughter, the Laughie may also alleviate loneliness. Daily laughter frequency is an important component of general physical and mental health [33], and Laughie reach-out can therefore be broadly investigated, including, for example to benefit cardiovascular health [34].

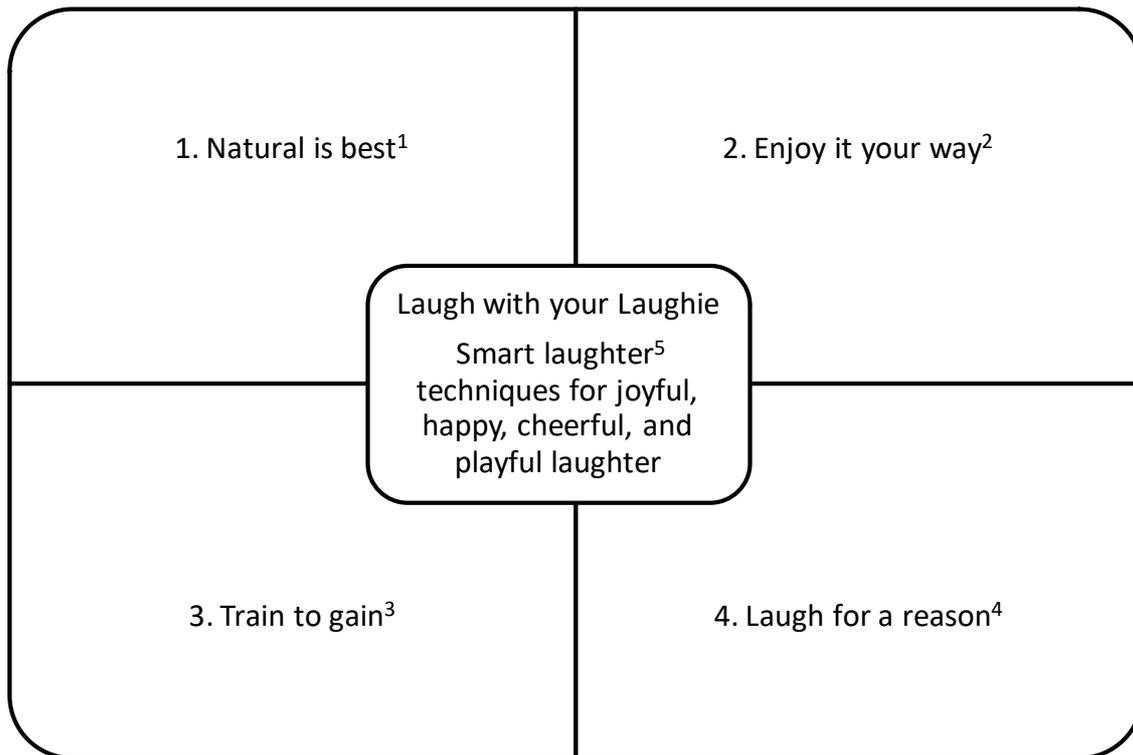
4.3. Acceptability

Analysis of participant experiences established acceptability. Most participants enjoyed solo laughter and valued discovering a powerful form of expression and self-communication. Nevertheless the idea that laughing alone could be perceived as ‘*crazy*’ tainted perceptions: Sylvie (93) was worried about being labelled senile, and Laughie usage at work was particularly awkward. Increased understanding of the beneficial applications of solo laughter can widen acceptability; to encourage this it would be helpful to de-marginalize solo laughter within gelotology [13]. Although solo laughter is less frequent than social laughter [10], the Laughie demonstrates that it can be a smart and powerful addition to social laughter, not an inferior inconsequential form of it.

4.4. Maintenance

Laughie maintenance was evaluated by analysing the Laughie checklists and exploring usage and motivation. Effective, enjoyable, and on-going Laughie usage was associated with four smart laughter techniques, as presented in Figure 2.

Figure 2. Smart laughter techniques for Laughie usage



Note. 1. Aim for a natural-sounding Laughie and laughter 2. Adding visual (e.g. a mirror), gestural; mental (e.g. joyful or amusing memories); or social (e.g. sharing a Laughie) elements. 3. Practice and effort. 4. Meaning e.g. for health, happiness, joy, humour, exercise, relaxation, meditation and energy. 5. Laughing in a smart way, for a smart reason, on a smartphone.

‘Natural is best’ reflects feedback that fake-sounding Laughies were neither effective nor enjoyable. This is supported by research: laughter authenticity influences perceptions, and laughter that is perceived as more genuine is also more contagious [35]. ‘Enjoy it your way’ enables personalised usage according to preferences, needs and circumstances. ‘Laugh for a reason’ inverses the technique initially suggested. While laughing for no reason is sometimes suggested in group interventions [6], as Provine [10] notes social laughter needs no reason as it is the reason. Meaning is central to well-being [36], and participants related their solo laughter to health, happiness, humour, and self-discovery. ‘Train to gain’ reflects the effort needed: solo laughter is unusual, and circumstances are not always amenable to it.

4.5. Efficacy

Laughie efficacy was evaluated by comparing pre- and post-intervention well-being scores, analysing Laughie checklists, and exploring participant experiences. Three minutes of daily laughter was sufficient to increase and sustain well-being in the majority of participants considerably reducing existing suggestions. It was also effective in increasing well-being to 'safe' levels in six participants with baseline well-being below 50%. An accessible, short laughter prescription is an important consideration as daily laughter frequency is correlated with physical and mental health [33, 34]. Nevertheless one third of participants did not report significant absolute post-intervention well-being increases, including all participants with high baseline well-being (80% plus). Only half of the sample found their Laughie to be self-contagious; this may have impacted efficacy.

Holistic well-being benefits included better sleep, particularly for those with low baseline well-being scores, and better mood. The Laughie could relax and energize; effects that participants compared to physical exercise. Laughter is a physical exercise, three minutes of laughter can produce the same effects as 25 sit-ups [37] (p.228), and some found the Laughie physically challenging. The Laughie was found to reduce anxiety, anger, and stress, confirming laughter's role in the de-escalation of negative emotions [11]. Laughing with the Laughie was also reported to ignite humorous thoughts, which suggests that laughter is not only a reaction to humour [12] but also a driver of humour.

A 'safe' location may be critical for Laughie usage: two participants reported it ineffective or counter-productive when they were stressed and in an office environment. The Laughie was also reported to be ineffective in very low mood when purposefully contemplating humorous incidents to laugh. Mirthful laughter can be compromised in difficult circumstances and training a humour response may be helpful [38]. Joyful,

happy, cheerful and playful laughter, the Laughie ‘default’ is recommended as it liberates from the need for ‘funniness’. However Laughie laughter entails practice, particularly, as this research suggests, for those who associate laughter to humour.

Many effects of the Laughie were ‘pseudo-social’ [10] e.g. memories, humour, feeling surrounded, and increased social laughter after usage was clearly social. However this does not explain why laughing alone was so enjoyable, why participants who easily could share their Laughie rarely did, or explicitly preferred not to, nor does it explain the self-discovery benefits participants described. Laughter is associated with diverse brain regions, many of which are not implicated in social laughter [39]. As well-being and personal growth are interlinked [40], the idea that laughter serves a personal development function is credible. Additional evidence reinforces this possibility: 17-day old babies laughing alone in their sleep [41]; primary school children enjoying laughing alone [42]; and the role of laughter in infant [43] and student learning [44]. Laughter serves ‘myriad functions’ on multiple levels [45], and extending research in gelotology from its social-laughter-centricity to investigate the personal development function of laughter is of interest.

4.6. Implementation

Suggestions for improving Laughie support and future dissemination were evaluated. Future demonstrations can emphasize smart laughter techniques as authenticity is important to trigger laughter [35]. Practice time and group demonstrations may be tested. Dissemination suggestions to add the Laughie to daily routines and exercise regimes can be explored.

4.7. Tailorability

Participant experiences of personalising usage, and their suggestions for Laughie design modification, were evaluated. As enjoyable approaches varied individually the smart laughter technique ‘enjoy it your way’ should be encouraged. Design modification may be appropriate. Visual elements can increase laughter [11] and a video element is recommended if a natural-sounding Laughie is insufficient to elicit laughter or enjoyment. Prescriptions should consider individual differences and needs: 30-seconds may be considered if one minute is too physically challenging or painful, as can less frequent usage, including once well-being levels are increased.

4.8. Strengths and limitations

Methodological limitations potentially impacted results. The sample size was small, convenience sampling was used, there was no control group, and the intervention only lasted one week. Participants were known to, or recommended by people known to the researcher, and demographics were skewed: a majority were female and most were economically privileged. Testing instructions can be clarified as several participants did not explore ways to enjoy their Laughie. As Laughie effects were variable, testing over a longer period using larger, more representative and randomised samples, and a control group, would be needed before generalising results.

4.9. Future research

Wider general testing and exploring Laughie usage in specific populations, including the depressed, and lonely, is recommended. A Laughie cost analysis may be beneficial. Closer investigation of laughter self-contagion may optimise its use to trigger laughter. Insight into the physiological benefits associated with Laughie usage may advance laughter’s potential as an exercise in itself. Analysis of Laughie recordings can be used to compare individual laughter parameters. Exploring perceived social laughter frequency

post-intervention also merits attention. Humour resulting from Laughie usage may also be investigated to consider its use to facilitate positive humour styles.

5. Conclusions

This is the first study to evaluate the feasibility of a laughter prescription to improve well-being in healthy adults. Preliminary exploration showed that well-being increased in most participants, and that most also found the Laughie enjoyable and convenient to use. This suggests the Laughie may be a feasible and easy-to-use intervention for improving well-being in healthy adults. FRAME-IT was practical for planning and evaluating an intervention at an early stage of development. Three findings extend the field of gelotology: solo laughter can be enjoyable and beneficial, laughter can be self-contagious, and laughter appears to have a personal development function.

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