

1 **Title:** Is Kambô psychoactive? Acute and subacute effects of the secretion of the  
2 Giant Maki Frog (*Phyllomedusa bicolor*) on human consciousness.

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4 **Author names:** Timo Torsten Schmidt<sup>1,2</sup> [titoschmi@zedat.fu-berlin.de](mailto:titoschmi@zedat.fu-berlin.de)  
5 Simon Reiche<sup>1</sup> [simon.reiche@charite.de](mailto:simon.reiche@charite.de)  
6 Caroline L. C. Hage<sup>1</sup> [clchage@gmail.com](mailto:clchage@gmail.com)  
7 Felix BERPohl<sup>1</sup> [felix.bermpohl@charite.de](mailto:felix.bermpohl@charite.de)  
8 Tomislav Majić<sup>1\*</sup> [tomislav.majic@charite.de](mailto:tomislav.majic@charite.de)  
9

10

11 **Author Affiliations:** <sup>1</sup> Department of Psychiatry and Psychotherapy, Berlin Institute of Health,  
12 Charité Universitätsmedizin Berlin, corporate member of Freie Universität  
13 Berlin, Humboldt-Universität zu Berlin, Campus Charité Mitte, Berlin,  
14 Germany

15 <sup>2</sup> Department of Education and Psychology, Neurocomputation and  
16 Neuroimaging Unit (NNU), Freie Universität Berlin, Germany

17

18

19 **Corresponding Author:** Tomislav Majić, M.D.  
20 Psychiatrische Universitätsklinik der Charité im St. Hedwig Krankenhaus  
21 Große Hamburger Straße 5-11  
22 10115 Berlin  
23 [tomislav.majic@charite.de](mailto:tomislav.majic@charite.de)  
24 Phone: +49 (0)30 2311 2013  
25

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36 motivation, Rapé, ayahuasca, Daime, afterglow, psychedelic

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38

39 **ABSTRACT**

40 Kambô is the name for the secretion of the Giant Leaf Frog (*Phyllomedusa bicolor*) containing a  
41 plethora of bioactive peptides. Originally, it is ritually used by different ethnicities from the Amazon  
42 basin as a remedy against bad luck in hunting. In the last twenty years, Kambô has spread to Western  
43 urban centers, often associated with the use of ayahuasca. Anecdotal reports claim beneficial effects  
44 on wellbeing and different medical and mental health conditions. However, to date it has been  
45 controversial if Kambô elicits altered states of consciousness. Here we retrospectively investigated  
46 acute and subacute psychological effects of Kambô in a sample of  $n = 22$  anonymous users ( $n = 22$ ,  
47 mean age: 39 years,  $\pm 8.5$ ; 45.5% female), administering standardized questionnaires for the  
48 assessment of psychoactive effects. Acutely, participants reported psychological effects which  
49 remained on a mild to moderate level, but no psychedelic-type distortions of perception or thinking.  
50 In contrast, persisting effects were predominantly described as positive and pleasant, revealing  
51 surprisingly high measures of personal and spiritual significance. Subacute and long-term effects  
52 showed some overlap with the “afterglow” phenomena that follow the use of serotonergic  
53 psychedelics.

54

55 **KEYWORDS:**

56 Kambô, Giant Leaf Frog, *Phyllomedusa bicolor*, ayahuasca, afterglow, psychedelic, dermorphin,  
57 caerulein, sauvagin, deltorphin

## 58 INTRODUCTION

59 Kambô is the Matsé name for the secretion of the Giant Leaf Frog (*Phyllomedusa bicolor*), which is  
60 ritually used by different ethnicities in the Amazon basin of Brazil and Peru <sup>1</sup>. A variety of potent  
61 bioactive peptides have been identified in the frog's secretion, including phyllocaeruelin, phyllokinin,  
62 phyllomedusin, sauvagine, deltorphin <sup>2</sup>, adrenoregulin, and the potent opioids dermorphine and  
63 caeruelin <sup>1</sup>. Kambô is obtained from the frog by carefully tying it up and rubbing its skin with a hard  
64 instrument, collecting the secretion on a wooden stick. It has been emphasized that in most cases the  
65 frog is treated with utmost respect and caution, in order to not harm it, and released it to its natural  
66 habitat once that the secretion is collected <sup>3</sup>.

67 Given its low oral bioavailability, Kambô is most commonly applied by the applicator to the recipient  
68 via several fresh superficial burns ("dots") on the arms, legs or chest <sup>4</sup>. Anecdotally, it has been  
69 described that within minutes, the secretion likely enters the lymphatic system and subsequently the  
70 blood, thereby inducing an intense reaction that includes hypotension, sweating, tachycardia, heavy  
71 vomiting and edema, usually subsiding within an hour. This is followed by listlessness or sleep and,  
72 subsequently, a state "perhaps to be described as euphoric", characterized by increased stamina and  
73 clarity of thoughts with an increased capacity for hunting <sup>1</sup>. In Amazonian ethnicities, Kambô is used as  
74 a cleansing ritual to liberate hunters from "bad principles" or bad luck in hunting ("panema"),  
75 enhancing the recipient's capacities once that cleansing has occurred and acute effects have subsided<sup>5</sup>.

76 During the last 20 years, Kambô has found its way to Western urban centers in Brazil and all over the  
77 world <sup>6</sup>. Notably, to date none of the substances that have been identified in the Kambô secretion  
78 display any serotonergic activity. However, from its Amazonian origins to its use in the context of  
79 Brazilian syncretic religions like the Santo Daime and the União do Vegetal <sup>5</sup> and, finally, to its use in  
80 Western healing circles, Kambô has often been associated with the spread of the serotonergic  
81 psychedelic ayahuasca <sup>7</sup>. Ayahuasca is an Amazonian shamanic concoction of different plants, including  
82 plants (e.g. *Psychotria viridis*) which contain the serotonergic psychedelic N,N-dimethyltryptamine  
83 (N,N-DMT) and Banisteriopsis caapi, which contain inhibitors of monoaminoxidase (MAO-I) that render  
84 N,N-DMT orally active <sup>8</sup>. Notably, Kambô does not necessarily have to be applied by a shaman and is  
85 not considered as a shamanic ritual itself, in contrast to ayahuasca and other ritual plants, where use  
86 is restricted to a shamanic framework <sup>9</sup>. During its spread to Western urban centers, however, the  
87 Kambô ritual has been transformed from a hunting ritual into therapeutic approaches and a neo-  
88 shamanic healing ritual, a process which has been labeled as "shamanization of Kambô" <sup>10</sup>.

89 The association with ayahuasca, however, is not the only connection between Kambô and nature-  
90 derived serotonergic psychedelics. Notably, different names used for the frog's secretion include  
91 "Kambô", "kampu", "vaccino da floresta" and also "sapo", which incorrectly means "toad" in Spanish.

92 This variability of the terms has sometimes led to a confusion of Kambô with the secretion of the  
93 Sonoran Desert Toad (*Bufo alvarius*), which is also referred to as “sapo”<sup>7</sup>. In contrast to Kambô,  
94 however, the toad’s secretion contains the potent serotonergic psychedelics 5-methoxy-N,N-  
95 dimethyltryptamine (5-MeO-DMT)<sup>11</sup> and bufotenine, which is usually smoked or snorted, immediately  
96 inducing strong psychedelic experiences<sup>12</sup>. Given the different application routes, the two substances  
97 are usually not confused by users, even though ceremonies where secretions from Kambô and *Bufo*  
98 *alvarius* are combined have recently been proposed in Western psychedelic circles.

99 Another interesting overlap between Kambô and the use of plant-derived psychedelics can be found  
100 in anecdotal reports describing beneficial after-effects on wellbeing, medical and mental health  
101 problems and personal and spiritual development<sup>13</sup> – attributes which have previously been  
102 associated with the use of serotonergic psychedelics. Of note, the effects of serotonergic psychedelics  
103 underlie unique temporal dynamics, with distinct acute (“*psychedelic experiences*” or “*states*”) and  
104 subacute effects (“*afterglow phenomena*”) <sup>14</sup>. Afterglow phenomena have been conceptualized as  
105 states of “elevated and energetic mood with a relative freedom from concerns of the past and from  
106 guilt and anxiety”, which are associated with an enhanced willingness “to enter into close interpersonal  
107 relationships”, lasting between two weeks and a month<sup>15</sup>. If these effects are comparable to the after-  
108 effects of Kambô is an open question.

109 Despite the close cultural and sub-cultural associations between the use of Kambô and different  
110 nature-derived psychedelics, no systematic characterization of the acute or subacute effects of Kambô  
111 has been reported. Here, we report results of a paper-pencil study among Kambô users employing  
112 standardized and validated questionnaires to retrospectively report acute and subacute effects of  
113 Kambô. This assessment allows a direct comparison to data from other psychoactive substances and  
114 answers in how far the effects of Kambô display similarities with serotonergic psychedelics<sup>16</sup>.

115 Our study was designed to (1) systematically characterize the acute effects of Kambô, enabling a direct  
116 comparison to acute effects of e.g. plant-derived serotonergic psychedelics, (2) explore if Kambô  
117 displays subacute effects which might be comparable to the psychedelic afterglow phenomena,  
118 including retrospective appraisal of the experiences by the recipients.

119

## 120 **RESULTS**

### 121 *Sample characteristics*

122 N = 27 datasets were sent back to us, of which n = 5 were excluded due to an insufficient reliability  
123 index in the PCI (cut-off  $h > 2$ ), leaving a final dataset of n = 22 for the first part of the study. The  
124 consecutive part of the study on the subacute effects of Kambô was completed by n = 14, where one

125 PEQ dataset and one CS dataset were excluded due to inappropriate completion, leaving for each n=13  
 126 datasets.

127 The sample characteristics are summarized in **Table 1**. With regards to lifetime drug consumption, 15  
 128 participants (68.2%) reported experiences with serotonergic hallucinogens (e.g., LSD, DMT, DOM), and  
 129 19 (86.4%) reported experiences with ritual plants or traditional indigenous medicines (e.g.,  
 130 ayahuasca, peyote, San Pedro, psilocybin mushrooms, ibogaine, 5-MeO-DMT, bufotenin). Participants  
 131 reported consumption of other psychotropic substances in their lifetime as follows: cannabis (n = 21,  
 132 95.5%), opioids (n = 7, 32.8%), cocaine (n = 10, 45.5%), amphetamine (n = 13, 59.1%), MDMA (n = 15,  
 133 68.2%), tranquilizer (n = 4, 18.2%).

134 Participants were asked to report on the importance of spiritual practices in their life on a scale from  
 135 (0 = "not at all" to 100 = "extraordinarily important"), which resulted in an average of 72.7% ( $\pm$  21.8%).

136 \*\*\*\*\*

137 TABLE 1 approximately here

138 \*\*\*\*\*

**Table 1: Sample characteristics**

	mean $\pm$ SD	n (%)
Age	39.0 $\pm$ 8.5	
Sex, female		10 (45.5)
Age, first Kambô experience	37.2 $\pm$ 8.3	
Lifetime Kambô experiences	4.7 $\pm$ 5.1	
Time since last Kambô experience		
< 1 week		11 (50.0)
1 week – 30 days		4 (18.2)
31 days – 12 month		1 (4.5)
1 – 5 years		3 (13.6)
> 5 years		2 (9.1)
No answer		1 (4.5)

N = 22

139

140

141 ***Acute subjective effects of Kambô***

142 The Kambô secretion was administered for n = 15 (68.2%) participants by an alternative health  
143 practitioner, western healer or “neo-shaman”. In n = 2 (9.1%) cases an indigenous shaman and in n =  
144 3 (13.6%) cases a layperson was reported to have administered Kambô (n = 1 “other” and n = 1 not  
145 specified). N = 14 (63.6%) of the participants reported being the only client while receiving Kambô,  
146 while n = 7 (31.8%) received it in a group setting (n = 1 not specified). The setting and environment  
147 was described as follows: a healing place or temple (n = 11, 52.4%), at home (n = 4, 19.0%), in nature  
148 (n = 2, 9.5%), in a ceremony (n = 2, 9.5%), other (n = 2, 9.5%), in a friend’s home (n = 1, 4.8%), with an  
149 alternative health practitioner practice (n = 1, 4.8%), at a festival (n = 1, 4.8%), on vacation (n = 1, 4.8%).

150 Participants reported that Kambô was applied via an average of  $7 \pm 2$  burning points on the  
151 participants' skin. The acute experience lasted less than 15 minutes for n = 6 (27.3%) participants,  
152 between 30 and 59 minutes for n = 11 (50.0%) participants, 60 minutes or longer for n = 3 (13.6%)  
153 participants (n = 2 not specified). We asked participants explicitly if they thought that Kambô induces  
154 a “Rauschzustand” (German word for “inebriation” or “high”), and n = 5 (22.7 %) reported “Yes”.

155 Acute effects were assessed retrospectively using the ASC rating scale, the PCI, the MEQ and CEQ to  
156 assess altered state experiences allowing for direct comparison to hallucinogenic substances and non-  
157 pharmacological methods that elucidate psychotropic effects. **Figure 1** and **Table 2** summarize results  
158 of the ASC rating scale, the PCI, MEQ30 and CEQ.

159 \*\*\*\*\*

160 TABLE 2 approximately here

161 FIGURE 1 approximately here

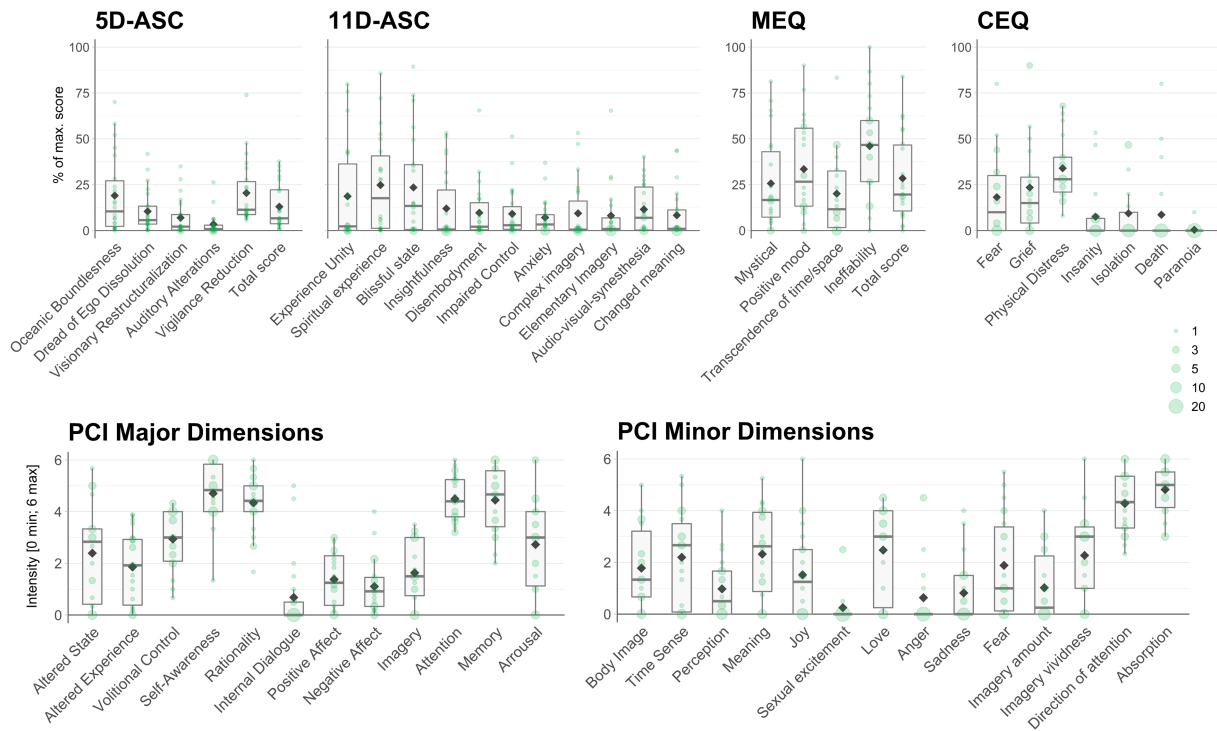
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**Table 2: Group level summary statistics for acute effects.**

	Mean	SD	t-value	p-value
<b>5D-ASC</b>				
Total ASC score	13.0	12.4	4.94	0.000
Oceanic Boundlessness	19.1	21.2	4.22	0.000
Dread of Ego Dissolution	10.5	11.5	4.26	0.000
Visionary Reconstructualization	7.0	10.0	3.26	0.002
Auditory Alterations	3.4	6.3	2.57	0.009
Vigilance Reduction	20.5	17.3	2.84	0.005
<b>11D-ASC</b>				
Experience of Unity	18.7	26.8	3.27	0.002
Spiritual Experience	24.8	26.3	4.42	0.000
Blissful State	23.5	28.0	3.94	0.000
Insightfulness	12.0	19.2	2.93	0.004
Disembodiment	9.7	15.7	2.89	0.004
Impaired Control and Cognition	9.1	13.6	3.15	0.002
Anxiety	7.1	9.6	3.47	0.001
Complex Imagery	9.4	16.4	2.68	0.007
Elementary Imagery	8.1	15.5	2.46	0.011
Audio-Visual Synesthesia	11.6	13.1	4.15	0.000
Changed Meaning of Percepts	8.3	13.9	2.82	0.005
<b>PCI</b>				
Altered State of Awareness	2.4	1.9		
Altered Experience	1.9	1.4		
Volitional Control	2.9	1.1		
Self-Awareness	4.7	1.1		
Rationality	4.3	1.1		
Internal Dialogue	0.7	1.4		
Positive Affect	1.4	1.1		
Negative Affect	1.1	1.1		
Imagery	1.6	1.2		
Attention	4.5	0.9		
Memory	4.4	1.3		
Arousal	2.7	1.9		
Body Image	1.8	1.5		
Time Sense	2.2	1.8		
Perception	1.0	1.1		
Meaning	2.3	1.7		
Joy	1.5	1.7		
Sexual excitement	2.5	1.8		
Love	0.6	1.4		
Anger	0.6	1.4		
Sadness	0.8	1.2		
Fear	1.9	1.9		
Imagery amount	1.0	1.3		
Imagery vividness	2.3	1.7		
Direction of attention	4.3	1.2		
Absorption	4.8	1.0		
<b>MEQ</b>				
Mystical	25.7	25.1	4.79	0.000
Positive Mood	33.5	26.4	5.95	0.000
Transcendence of time and space	20.2	21.8	4.34	0.000
Ineffability	46.1	27.0	8.01	0.000
Total Score	28.5	23.4	5.72	0.000
<b>CEQ</b>				
Fear	18.2	21.9	3.53	0.001
Grief	23.5	27.1	3.68	0.001
Physical Distress	34.0	17.9	8.07	0.000
Insanity	7.6	14.6	2.20	0.021
Isolation	9.4	17.3	2.30	0.017
Death	8.6	21.0	1.74	0.050
Paranoia	0.5	2.1	0.90	0.189

N = 22; To allow direct comparison with previous datasets mean  $\pm$  SD for all group level scores of the applied questionnaires are provided. For the 5D-ASC, 11D-ASC, MEQ, CEQ scores, we performed one sample t-tests (df = 21) against zero and provide p-values. Please note that data is reported in its completeness and raw significance values are reported instead of significance thresholding. Note: The scores of the ASC, MEQ and CEQ are designed to assess differences from zero, while the PCI items are anchored with two opposing statements (See Methods) to the end of the scale [0: minimum; 6: maximum], therefore not being tested against zero.

164



165

166 **Figure 1: Acute subjective effects of Kambô**

167 Acute effects (n = 22) were assessed with standardized psychometric tools that allow direct comparisons to consciousness  
 168 alterations induced by different methods as e.g. found on the Altered States Database <sup>16</sup>. Note: The scores of the ASC, MEQ  
 169 and CEQ are designed to assess differences from zero, while the PCI items are anchored with two opposing statements (See  
 170 Methods) to the end of the scale [0: minimum; 6: maximum], thereby not assessing differences from zero but characterizing  
 171 the overall pattern of experience. Note: In comparison to Table 2, the box plots provided here show the data distribution.  
 172



173 ***Subacute subjective effects of Kambô***

174 The PEQ and the CS were filled in only when the exemplary Kambô session happened 2 - 3 weeks  
175 before filling in the questionnaires. Together these questionnaires cover a broad spectrum of  
176 subjectively experienced subacute effects. Results are summarized in **Figure 2** and **Table 3**.

177 \*\*\*\*\*

178 TABLE 3 approximately here

179 FIGURE 2 approximately here

180 \*\*\*\*\*

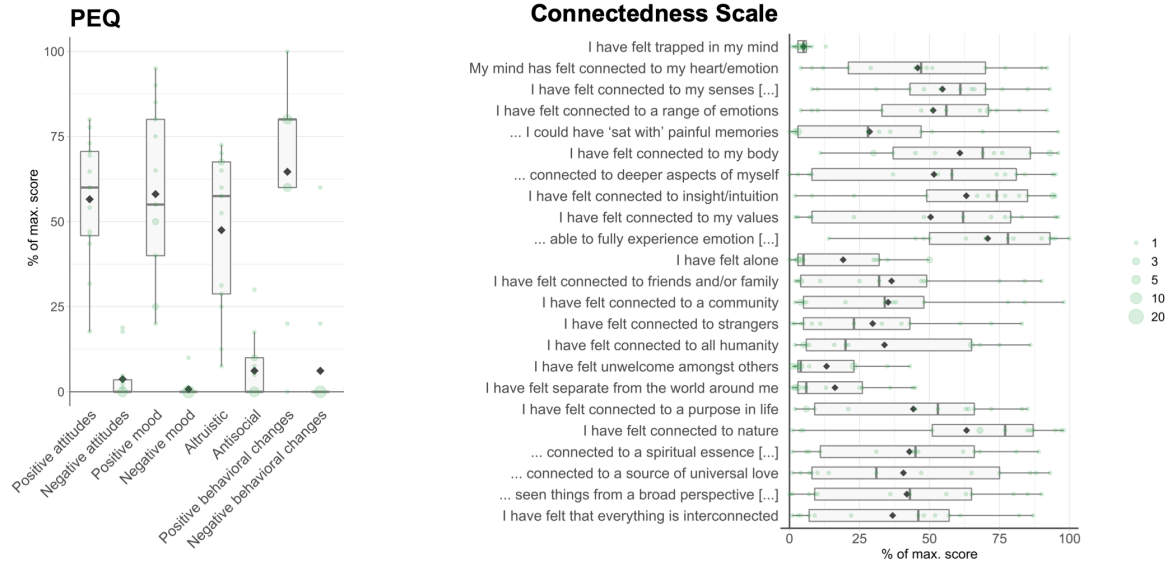
181 When asked about the spiritual relevance of the Kambô experiences, n = 6 of 13 (46%) participants  
182 rated it as strongly spiritually significant, including n = 2 participants who rated it as the single most or  
183 among the five most spiritually significant experiences of their life. When asked how personally  
184 meaningful the experience was, n = 7 of 13 (54%) participants rated the experience among the ten  
185 most meaningful experiences of their life and n = 4 rated it among the five most personally meaningful  
186 experience. One participant viewed it as the single most personally meaningful experience in his life.  
187 Regarding change of well-being or life satisfaction, n = 8 of 13 (62%) participants stated that the  
188 experience increased well-being or life satisfaction slightly, and n = 5 of 13 (38%) participants reported  
189 an increase in well-being or life satisfaction between 'moderate' and 'very much'.

**Table 3: Group level summary statistics for subacute effects**

	mean	SD	T	p
<b>Persistent Effects Questionnaire (PEQ)</b>				
Positive attitudes about life or self	56.6	18.7	10.89	0.000
Negative attitudes about life or self	3.7	6.6	2.02	0.033
Positive mood changes	58.1	25.9	8.10	0.000
Negative mood changes	0.8	2.8	1.00	0.169
Altruistic/positive social effects	47.5	23.2	7.38	0.000
Antisocial /negative social effects	6.2	9.1	2.44	0.016
Positive behaviour changes	64.6	27.3	8.54	0.000
Negative behaviour changes	6.2	17.1	1.30	0.109
<b>Connectedness Scale (CS)</b>				
I have felt that everything is interconnected	36.8	30.8		
I have seen things from a broad perspective; the 'bigger picture'	41.9	33.6		
I have felt connected to a source of universal love	40.7	36.2		
I have felt connected to a spiritual essence (in the secular or religious sense)	42.8	29.8		
I have felt connected to nature	63.2	36.6		
I have felt connected to a purpose in life	44.2	31.2		
I have felt separate from the world around me	16.2	16.8		
I have felt unwelcome amongst others	13.2	14.4		
I have felt connected to all humanity	33.9	32.1		
I have felt connected to strangers	29.7	28.3		
I have felt connected to a community	35.2	33.4		
I have felt connected to friends and/or family	36.5	31.9		
I have felt alone	19.2	19.2		
I have been able to fully experience emotion, whether positive or negative	70.8	25.6		
I have felt connected to my values	50.4	36.8		
I have felt connected to insight/intuition	63.2	32.6		
I have felt connected to deeper aspects of myself	51.6	36.4		
I have felt connected to my body	60.8	28.4		
If I had chosen to, I could have 'sat with' painful memories	28.6	30.7		
I have felt connected to a range of emotions	51.3	29.4		
I have felt connected to my senses (touch/taste/sight/smell/hearing)	54.6	26.3		
My mind has felt connected to my heart/emotions	45.8	30.1		
I have felt trapped in my mind	5.0	3.0		

Note that data (n=13, each for CS and PEQ) is reported in its completeness and raw significance values are reported instead of significance thresholding. For the PEQ scores we performed t-tests against zero and provide p-values.

190



191

192 **Figure 2: Subacute subjective effects of Kambô**

193 Subacute effects (n = 13) were assessed with the PEQ and the CS and are displayed as box plots for the dimensions or items

194 of the two questionnaires. Note: In comparison to Table 3, the box plots provided here illustrate the data distribution.

195 **DISCUSSION**

196 In our study investigating effects of Kambô – the secretion of the Giant Maki Frog (*Phyllomedusa*  
197 *bicolor*) – on human consciousness, we report three major findings: (1) Regarding the acute period of  
198 the pharmacological action, only subtle effects on consciousness were recorded, not comparable to  
199 serotonergic psychedelics with regard to qualitative aspects and intensity; (2) Participants reported  
200 positive subacute after-effects, which in some aspects showed overlaps with psychedelic “afterglow”  
201 phenomena; (3) About half of the participants retrospectively appraised their experiences with Kambô  
202 as both highly spiritually and personally relevant for their lives, analogous to appraisals of mystical  
203 experiences reported under high dosages of serotonergic psychedelics.

204 ***The acute effects of Kambô***

205 In the first part of our study, we set out to test if Kambô induces acute altered states of consciousness  
206 (ASCs) comparable to psychedelics. The core of psychedelic experience is currently best assessed with  
207 the 11D-ASC questionnaire, the most commonly used tool to assess drug-induced ASCs. The 11D-ASC  
208 allows for characterization of subjective effects along 11 dimensions of change in conscious  
209 experience. Psychedelic experiences are typically characterized by high scores on the scales  
210 *Elementary and Complex Imagery, Insightfulness, Spiritual Experience, Experience of Unity and Blissful*  
211 *State*<sup>16</sup>. In contrast, for Kambô we found only relatively low scores on these dimensions. Thus, our  
212 study demonstrates with standardized questionnaire data that Kambô does not elicit effects on  
213 consciousness comparable to serotonergic psychedelics, especially no comparable effects are reported  
214 on perception and thinking.

215 Moreover, we applied the Mystical Experience Questionnaire (MEQ). This tool is used to test for the  
216 occurrence of spiritual/mystical experiences, which are thought to have the potential to facilitate  
217 conversions, attitude-changes, or even life-changes under special circumstances. High values of “full-  
218 blown” mystical experiences have been reported for several serotonergic psychedelics including LSD  
219<sup>17</sup>, psilocybin<sup>18</sup>, and 5-methoxy-dimethyltryptamine<sup>19</sup>. In our sample, few participants reported  
220 pronounced aspects of mystical experiences, reflected by relatively low mean scores on the four MEQ  
221 factors, with a few higher outlier datapoints. Even if Kambô effects cannot be compared to intense  
222 mystical experiences as reported after the use of serotonergic psychedelics<sup>20</sup> with regard to intensity  
223 and completeness of the mystical state, our finding suggests that participants might have experienced  
224 psychological and spiritual effects beyond merely somatic reactions. However, this conclusion remains  
225 somewhat speculative, and setting as well as expectational and setting factors could have contributed  
226 to this effect.

227 The Challenging Experience Questionnaire (CEQ) includes self-report items designed for the  
228 investigation of challenging experiences under psilocybin and other serotonergic psychedelics. These

229 include fear, grief, physical distress, insanity, isolation, fear of death and paranoia, which are symptoms  
230 that can occur in challenging experiences (also referred to as “bad trips”) under serotonergic  
231 psychedelics<sup>21</sup>. The challenging experiences reported for acute effects of Kambo were mostly limited  
232 to “physical distress”. Challenging experiences of a rather psychological nature were barely reported  
233 – suggesting unspecific fearful reactions to the strong vegetative effects, but without induction of  
234 psychedelic-type psychological crises including insanity, isolation, death or paranoid ideation in the  
235 sense of “bad trips”, reflecting distortions of ego functions and self-processing.

236 Ratings on the Phenomenology of Consciousness Inventory (PCI) allow for comparison of Kambo  
237 experiences with hypnosis or meditation techniques to investigate potential shared aspects. Similar to  
238 hypnotic or meditative states, participants reported a reduction of positive and negative affect in their  
239 Kambô experiences (Pekala 2017). With regard to the question if or how Kambô elicits psychoactive  
240 effects, it is noteworthy that the obtained scores on “self-awareness”, “rationality”, “attention” and  
241 “memory” indicate that the participants did not feel confused or muddled, which would be expected  
242 from centrally active drugs like alcohol or barbiturates.

243 Taken together, our study provides standardized data that allows a direct comparison of Kambô  
244 experiences to the effects of well-known psychoactive substances. On the physiological level, the acute  
245 Kambô experience is dominated by an intensive physical reaction, which is reflected in the reports of  
246 “physical distress” by our participants and is also likely to have triggered psychological distress in some  
247 participants. The process of characterizing acute Kambô effects with standardized questionnaires in  
248 the present study revealed that Kambo induces a state of self-centered inwardness. This state does  
249 not have typical characteristics of psychedelic-induced states. Although the pharmacodynamics of the  
250 Kambô secretion have only been partially investigated, it has been suggested that Kambô’s  
251 pharmacological effects are restricted to the cardiovascular, gastroenterological, endocrine and  
252 immune systems, the autonomic nervous system (ANS) and the endogenous opioid system<sup>9</sup>. On the  
253 one hand, this appears to be plausible given the compounds’ peptide structures which prevent them  
254 from passing the blood-brain barrier. On the other hand, the authors hypothesize that the  
255 neuropeptide opioids in Kambô (dermorphin, caerulein and deltorphin) could be responsible for the  
256 observed “alterations of consciousness”, suggesting psychoactive effects. However, given the  
257 neuropeptide structure, these opioids have been reported to be centrally active via intrathecal  
258 application only. In addition, the described acute and subacute effects of Kambô resemble stimulant  
259 effects rather than those of substances with mu-receptor activity. Thus, the observed acute and  
260 subacute effects in our sample are divergent from known psychoactive effects of mu-receptor  
261 agonists, suggesting that other compounds or complex interactions between vegetative, neuro-  
262 endocrinological and psychological effects might be considered as underlying biological correlates of  
263 the Kambô experience. Nevertheless, to date no compounds have been identified that could explain

264 the induction of an ASC during the acute period of Kambô effects and no such phenomena were  
265 reported by our participants.

### 266 ***The subacute effects of Kambô***

267 In the second part of our study, we investigated subacute effects of Kambô up to 2-3 weeks after the  
268 reported exemplary session to find first indications if these effects were comparable to psychedelic  
269 afterglow phenomena (See <sup>14</sup>). Since no systematic characterization of afterglow phenomena exists to  
270 date, even for psychedelics, a quantitative comparison was not possible. Therefore, as a first  
271 description of the subacute effects we used the PEQ, previously applied to characterize psychedelic  
272 effects mainly in therapeutic contexts. Additionally, we used a questionnaire measuring  
273 connectedness, which has not yet been validated.

274 Notably, subacute effects of Kambô were appraised very positively, including factors of “positive  
275 attitudes”, “positive mood”, “altruistic” and “positive behavioural changes”, whereas negative aspects  
276 have been reported to be negligible. This is in line with observations describing a euphoric state after  
277 the acute effects of Kambô have subsided <sup>1</sup>. Moreover, subacute effects involved dimensions of mood,  
278 overall wellbeing, but also aspects on a spiritual and transpersonal level. The intensity of subacute  
279 positive effects was pronounced, even if not as intense as after-effects of lysergic acid diethylamide  
280 (LSD) <sup>22</sup> or psilocybin <sup>23</sup>.

281 Interestingly, the ratings of items describing connectedness to *internal* aspects of oneself were high in  
282 our sample, such as being connected to “my senses”, “a range of emotions”, “my body”, “deeper  
283 aspects of myself” and “insight/intuition”, and to “have been fully able to experience emotion,  
284 whether positive or negative”. In contrast, ratings of items referring to connectedness to *external*  
285 aspects (e.g. “a community”, “strangers”, “all humanity”, “a purpose in life”, “spiritual essence” and  
286 “a source of universal love”) were far less pronounced, except for the experience of being “connected  
287 to nature”. This is in line with anecdotal observations including participants’ subjective experiences of  
288 an active interaction with a frog’s “spirit”, which detects and eliminates toxins and bad energy from  
289 their mind and body <sup>9</sup>. However, this finding is only partially comparable to mystical experiences  
290 associated with acute and subacute effects of serotonergic psychedelics, where states of increased  
291 connectedness to both the self and other beings have been reported <sup>23</sup>(i.e. the notion that “everything  
292 is interconnected”).

293 Notably, even if the subacute effects were not comparable to those reported after the use of  
294 serotonergic psychedelics regarding intensity and qualitative aspects <sup>22,23</sup>, some of the phenomena  
295 which outlasted the acute effects were surprisingly intensive and complex, showing overlaps with  
296 psychedelic “afterglow phenomena”, including increases in positive mood, behavior, attitudes and  
297 social interaction.

## 298 **Limitations**

299 The effects of Kambô reported by our study participants could partially be related to the ritualistic  
300 setting of consumption. Our data were collected retrospectively from a group of Western Kambô users  
301 recruited through a public workshop on Kambô and a group of practitioners devoted to a specific ritual  
302 setting. This might have induced a bias of expectations or motivations for use and thereby involved  
303 the placebo dimension. The observed variability in the assessed acute effects suggests that  
304 expectational factors and setting might have played a role for some reports. In order to make final  
305 conclusions about the psychoactive properties of Kambô, randomized placebo-controlled trials are  
306 necessary.

## 307 **Conclusion**

308 Our findings demonstrate that the acute effects of Kambô are very different from the effects of  
309 serotonergic psychedelics. While the acute effects of Kambô are dominated by strong physical  
310 reactions followed by a state of increased inwardness, psychedelic effects appear to facilitate  
311 loosening of ego barriers and increased connectedness with oneself and the outer world. Our findings  
312 are congruent with anecdotal reports that the subacute effects of Kambô include feelings of being  
313 energized with increased stamina and clarity of thoughts, following an initial state of physical sickness  
314 and exhaustion. Nevertheless, subacutely, Kambô does exhibit some overlap with serotonergic  
315 psychedelics in regard to the reported “afterglow” phenomenon<sup>15</sup>. This finding is striking given the  
316 unique temporal dynamics of subacute psychedelic effects, incomparable to any other group of  
317 psychoactive substances. Kambô thereby appears to be associated with afterglow-like effects, but  
318 without preceding psychedelic states. In agreement with our findings, it has been suggested that the  
319 transformative and transpersonal effects of Kambô might be comparable to those associated with the  
320 use of serotonergic psychedelics<sup>9</sup>.

321

## 322 **METHODS**

### 323 ***Participants and Procedure***

324 All data of this study was collected anonymously. Potential participants were recruited at a drug  
325 information event in Berlin and through Kambô practitioners who forwarded study material to their  
326 clients. Participants were informed about the study aim and that data collection is fully  
327 anonymously. They were handed out a printed set of paper/pencil-questionnaires together with a pre-  
328 paid envelope for returning completed sets of questionnaires and gave consent by filling the  
329 questionnaire and sending it back anonymously. All procedures were conducted in accordance with  
330 the Declaration of Helsinki and were approved by the Ethics committee of the Charité

331 Universitätsmedizin Berlin (EA2/185/17). All questionnaires were applied in German. The first set of  
332 questions addressed person specific characteristics, such as age, gender and drug consumption history.

333 Apart from questions referring to demographic information, a set of questionnaires was given to the  
334 participants that comprised the following two parts: (1) questionnaires on the acute effects of an  
335 exemplary Kambô session, (2) questionnaires on subacute effects of the exemplary Kambô session. All  
336 participants were requested to fill in demographic information and (1). Participants were asked to fill  
337 in (2) only if the exemplary Kambô session that they reported about in (1) happened between 2 - 3  
338 weeks ago, as the questions on the acute effects addressed this period after the Kambô session.

339 As exclusion criterion for data of insufficient quality we used the reliability index (h) of the  
340 Phenomenology of Consciousness Inventory (PCI), which is a measure for the participants consistency  
341 in completing the questionnaire <sup>24</sup>.

#### 342 ***Assessment of acute subjective effects of Kambô***

343 The second set of questions comprised four well established and validated psychometric tools to assess  
344 acute subjective experiences of consciousness alterations:

345 *Altered States of Consciousness (ASC) Rating Scale:* The ASC rating scale <sup>25,26</sup> originated from two  
346 former versions, the initial APZ (Abnormal Mental States; GERMAN: Abnorme Psychische Zustände) <sup>27-</sup>  
347 <sup>29</sup> and the revised version OAV <sup>30</sup> and has become one of the most frequently used questionnaires in  
348 the assessment of altered states of consciousness phenomena. The ASC rating scale is supposed to  
349 investigate characteristics of consciousness alterations that are invariant across various conditions  
350 including both pharmacological (e.g., psilocybin, ketamine, DMT) and behavioral induction methods  
351 (e.g., sensory deprivation, hypnosis, autogenic training). Over the course of more than 30 years, the  
352 questionnaire underwent several refinements finally leading to the currently used version which  
353 comprises 94 items <sup>25,26</sup>. Currently two different analysis schemata are used: the original 5-dimensional  
354 scheme (5D-ASC) and the 11-dimensional scheme (11D-ASC) <sup>31</sup>.

355 *Phenomenology of Consciousness Inventory (PCI):* The PCI was developed in the context of an  
356 interdisciplinary approach described as empirical-phenomenology <sup>24,32</sup>. Most notably influenced by C.  
357 T. Tart's (1975) conception of ASCs, where different states are characterized by distinct structures and  
358 patterns of the subjective experience <sup>24</sup> (p. 192). The PCI assesses subjective experiences along multiple  
359 dimensions, where corresponding scales were constructed on the basis of several cluster and factor  
360 analyses. Items are presented as two opposing statements (e.g. "I felt ecstatic and joyful" – "I felt no  
361 feelings of being ecstatic and joyful") located on the two poles of a 7-point Likert scale. We used the  
362 German version by <sup>33</sup>.



363 *Mystical Experiences Questionnaire (MEQ)*: The MEQ was first used in the ‘Good Friday Experiment’  
364 <sup>34,35</sup>, where it was intended to assess differences regarding aspects of mystical experience between a  
365 group taking psilocybin and a control group taking a placebo. Since then, the MEQ has been applied as  
366 an instrument for the quantitative assessment of pharmacologically induced mystical experience.  
367 Items of the MEQ were chosen based on literature about mysticism including first-person accounts as  
368 well as theoretical work, most notably by W. James (1902) and W. T. Stace (1960). The initial MEQ has  
369 been further developed by Pahnke (1969), Richards (1975), Griffiths et al. (2006; 2011), and MacLean  
370 et al. (2012). The most recent version is the MEQ30 <sup>36</sup>, a condensed version of the MEQ with thirty  
371 items and four empirical scales <sup>37 38</sup>.

372 *Challenging Experiences Questionnaire (CEQ)*: The CEQ was designed to provide a tool for the  
373 comprehensive assessment of acute negative effects of temporarily induced altered states of  
374 consciousness <sup>39</sup>, based on three questionnaires: Hallucinogenic Rating Scale (HRS), 5D-ASC, and States  
375 of Consciousness Questionnaire (SOCQ). The conceptual scope of the 26-item CEQ is informed by  
376 literature on psychological and physical distress following hallucinogen intake and covers a variety of  
377 adverse cognitive, affective, and somatic reactions which are clustered into seven distinct dimensions  
378 of challenging experiences <sup>37</sup>. Analyzing data from an online survey on negative experiences with  
379 psilocybin, corresponding scales for the first six dimension were derived by exploratory factor analysis,  
380 complemented by the Paranoia scale, and subsequently validated through confirmatory factor analysis  
381 <sup>39</sup>. Items are rated on a 6-point scale adopted from the SOCQ.

### 382 ***Assessment of subacute subjective effects of Kambô***

383 The third set of questionnaires addressing subacute effects was introduced with the instructions to fill  
384 out the following questionnaires only if the exemplary Kambo session (for which the acute effects were  
385 reported) had happened up to 3 weeks before the day of completing the questionnaire. The set of  
386 questions comprised the following two questionnaires:

387 *Items about Connectedness*: We used a previously unpublished set of 23 questions to measure  
388 different aspects of connectedness <sup>40</sup>. The items include aspects of connectedness to one’s self,  
389 connectedness to the universe and connectedness to others. The items stem from the development  
390 of a *connectedness scale (CS)*. As no validation or confirmation of a factor structure had been published  
391 until now, the scores on this scale are presented for the individual items.

392 *Persisting Effects Questionnaire (PEQ)*: The PEQ was developed as a follow-up questionnaire to the  
393 States of Consciousness Questionnaire (SOCQ), which was an intermediate version of the MEQ <sup>20</sup>. The  
394 PEQ assesses long-term changes in participants. We used a German version of the extended PEQ  
395 version reported in <sup>23</sup>. This version uses 140 items rated on a 6-point Likert scale from 0 (‘not at all’)

396 to 5 ('extremely'), and 3 items on the retrospective assessment of the importance and effects of the  
397 experiences.

### 398 **Data Analysis and Visualization**

399 Questionnaire data were analyzed using standardized analysis sheets. Data visualization was  
400 performed with RStudio v.1.2.1335 and package ggplot2 v.3.2.1. Boxplots represent the lower and  
401 upper hinges corresponding to the first and third quartiles (the 25th and 75th percentiles), the median  
402 as a horizontal bar and the whiskers indicate the range of the data (limited to 1.5 x interquartile range).  
403 Discrete individual data points are shown as green dots. To display overlapping data points the size of  
404 the dots represents the number of observations at each value. Data points not lying within the range  
405 of the whiskers are outliers. The mean, without any outlier exclusion, is displayed as a diamond shape.  
406 For comparability with previous reports, the means and SD for all questionnaire data are provided in  
407 **Table 2** (without outlier exclusion).

408

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412

### 413 **Data Availability:**

414 Data is available upon personal request.

415

### 416 **Competing Interests:**

417 The authors declare no competing interests.

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### 537 **Author Contributions Statement**

538 T.T.S. and T.M. designed the study. C.H., S.R. and T.T.S. analyzed the data, S.R. designed figures and  
539 tables and T.T.S., T.M. and F.B. wrote the manuscript. All authors edited the manuscript and approved  
540 its final version. All authors agreed to be personally accountable for their own contributions and to  
541 ensure that questions related to the accuracy or integrity of any part of the work, even ones in which  
542 the author was not personally involved, are appropriately investigated, resolved, and the resolution  
543 documented in the literature.

544