Appendix to "Discovering Bug Patterns in JavaScript"

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Contents

1   Introduction

This report is a companion to the paper "Discovering Bug Patterns in JavaScript", which is currently under submission at The 24th ACM SIGSOFT International Symposium on the Foundations of Software Engineering. This report provides detailed data on the basic change types, change types and bug patterns that are discussed in the conference paper at a high level.

2   List of Bug Pattern Groups

Table 2 gives one concrete example and lists the representative cluster IDs for each bug pattern group in our empirical study.

Table 1: Bug Pattern Groups

ID	Fault	Repair	Example Cluster	Example URL	Clusters
1	Dereferenced non-values	Protect with falsey check	37	https://github.com/jaruba/ PowderPlayer/commit/ 56345bde40fe5ecd16111c29d26f36b1d3bda8a2	5, 8, 37, 30, 40, 91, 95, 169, 172, 180
2	Dereferenced non-values	Protect with value check	55	https://github.com/jquery/jquery/commit/ c078b83b3fea891e0c228a9f2d101481678b4c9d	24, 55
3	Dereferenced non-values	Protect with type check	46	https://github.com/jaruba/ PowderPlayer/commit/ b46b19e9989d82a45ab7787032f59fdd0b6d912c	24, 46, 55, 99
4	Incorrect comparison	Compare fewer types	108	https://github.com/substack/ node-optimist/commit/ 49f9047d762402e28ffd3bdb99bf48120b406a65	55, 108, 181
5	Incorrect comparison	Compare more types	128	https://github.com/ prawnsalad/KiwiIRC/commit/ 27bca914b2b921d6b0b08e2d6afac0cc9c9cfe80	128
6	Missing argument	Add `null` placeholder	82	https://github.com/caolan/async/commit/ 639fb496f201c32b182a50f75db65d58348e4045	70, 82
7	Incorrect API configuration	Set boolean config option	1	https://github.com/Soundnode/ soundnode-app/commit/ a90d879e438746da5b9cff360c1b92cb8593034f	1, 7, 17, 43, 50, 116

8	this not correctly bound	Access `this` through closure	62	`https://github.com/mongodb/` `node-mongodb-native/commit/` `d9b1390d3f9972e239d05c1cb48e0e98b0a8e8d8`	62, 81
9	this not correctly bound	Bind `this`	9	`https://github.com/` `prawnsalad/KiwiIRC/commit/` `cd6579b32808e9294479101e7bbb6bcbe23803dc`	141
10	Unhandled error	Catch thrown exception	64	`https://github.com/` `prawnsalad/KiwiIRC/commit/` `9dc939b73a7308b611045681657d61df471af48a`	64
11	Unhandled error	Propagate to callback	134	`https://github.com/` `senchalabs/connect/commit/` `4638aea3d84e3b4b97f0df2fe1665d3e1c5c05ce`	134
12	Unhandled error	Check callback exception	180	`https://github.com/` `karma-runner/karma/commit/` `bb4edde9f15a07e6dac0d4dc01731f1e277d34a4`	180

3 List of Change Types

Table 2 lists the pervasive change types identified by BugAID in our empirical study.

Table 2: Change types. I: # of commits in the cluster, C: average # of modified statements, BCTs: # of basic change types, P: # of projects represented

ID	Signature	I	C	BCTs	P
1	RESERVED:ASSIGNMENT_RHS:INSERTED:true:1	125	1	1	35
2	RESERVED:CONDITION:INSERTED:sheq:1	114	1	1	42
3	RESERVED:METHOD_CALL:INSERTED:callback:1 RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:INSERTED:falsey:1	13	2	3	5
4	RESERVED:ARGUMENT:INSERTED:callback:1	10	1	1	6
5	RESERVED:CONDITION:INSERTED:falsey:1	655	1	1	67
6	RESERVED:METHOD_CALL:INSERTED:error:2	5	2	1	3
7	RESERVED:ASSIGNMENT_RHS:INSERTED:false:1	61	1	1	31
8	RESERVED:CONDITION:INSERTED:falsey:2	160	2	1	46
9	RESERVED:ARGUMENT:REMOVED:this:1	40	1	1	22
10	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:CONDITION:INSERTED:falsey:1	66	3	2	29
11	METHOD:METHOD_CALL:INSERTED:replace:1	52	1	1	21
12	RESERVED:METHOD_CALL:INSERTED:error:1	18	1	1	9
13	RESERVED:CONDITION:REMOVED:falsey:1	147	2	1	46
14	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:UPDATED:var:1	113	2	2	39
15	RESERVED:CONDITION:INSERTED:sheq:1 METHOD:METHOD_CALL:INSERTED:charAt:1	6	1	2	3
16	RESERVED:ASSIGNMENT_RHS:INSERTED:this:1	13	1	1	10
17	RESERVED:ASSIGNMENT_RHS:INSERTED:true:2	32	2	1	17
18	RESERVED:ASSIGNMENT_LHS:INSERTED:this:1	48	2	1	23
19	METHOD:METHOD_CALL:INSERTED:stringify:1 CLASS:METHOD_CALL:INSERTED:JSON:1	7	1	2	6
20	RESERVED:CONDITION:REMOVED:sheq:1	39	1	1	18
21	FIELD:ASSIGNMENT_RHS:INSERTED:prototype:1 FIELD:ASSIGNMENT_LHS:INSERTED:prototype:1	5	1	2	5

22	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:STATEMENT:INSERTED:new:1 RESERVED:CONDITION:INSERTED:typeof:1	11	2	3	8
23	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:REMOVED:var:1	9	4	3	7
24	RESERVED:CONDITION:INSERTED:undefined:1 RESERVED:CONDITION:INSERTED:typeof:1	28	1	2	16
25	METHOD:METHOD_CALL:INSERTED:filter:1	16	3	1	11
26	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:REMOVED:falsey:1	76	2	2	25
27	FIELD:EXPRESSION:INSERTED:length:1	5	1	1	5
28	RESERVED:ASSIGNMENT_LHS:INSERTED:this:1 RESERVED:ASSIGNMENT_RHS:INSERTED:true:1	10	1	2	6
29	RESERVED:ASSIGNMENT_RHS:INSERTED:true:1 RESERVED:STATEMENT:UPDATED:new:1 RESERVED:STATEMENT:UPDATED:var:1	9	1	3	5
30	RESERVED:ASSIGNMENT_LHS:INSERTED:this:2	5	2	1	3
31	RESERVED:ASSIGNMENT_RHS:INSERTED:null:1 RESERVED:STATEMENT:UPDATED:var:1	24	1	2	6
32	RESERVED:STATEMENT:INSERTED:var:1 METHOD:METHOD_CALL:INSERTED:replace:1	5	2	2	5
33	METHOD:METHOD_CALL:INSERTED:replace:2	6	1	1	5
34	RESERVED:CONDITION:INSERTED:sheq:2	17	3	1	11
35	RESERVED:CONDITION:INSERTED:typeof:1	13	1	1	10
36	RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:INSERTED:falsey:2	15	2	2	11
37	RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:INSERTED:falsey:1	85	2	2	36
38	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:ASSIGNMENT_RHS:INSERTED:true:1	5	2	2	4
39	METHOD:METHOD_CALL:REMOVED:stringify:1 CLASS:METHOD_CALL:REMOVED:JSON:1	9	1	2	6
40	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:UPDATED:return:1	44	1	2	20
41	RESERVED:ARGUMENT:INSERTED:true:1 RESERVED:STATEMENT:UPDATED:var:1	7	2	2	6
42	RESERVED:ARGUMENT:INSERTED:true:1	25	1	1	17
43	RESERVED:ASSIGNMENT_RHS:REMOVED:false:1	22	1	1	16
44	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:STATEMENT:INSERTED:return:1	24	2	2	15
45	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:REMOVED:var:1	6	3	2	6
46	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:INSERTED:typeof:1	76	1	2	36
47	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:UPDATED:var:1	16	3	3	13
48	METHOD:METHOD_CALL:INSERTED:bind:1	14	2	1	11
49	RESERVED:STATEMENT:INSERTED:return:1 RESERVED:STATEMENT:INSERTED:var:1 RESERVED:CONDITION:INSERTED:falsey:1	6	5	3	6
50	RESERVED:ASSIGNMENT_RHS:REMOVED:true:1	40	1	1	24
51	RESERVED:ASSIGNMENT_RHS:INSERTED:false:2	8	1	1	7

52	RESERVED:ASSIGNMENT_RHS:INSERTED:null:2 RESERVED:STATEMENT:UPDATED:var:1	9	1	2	2
53	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:INSERTED:falsey:1	9	2	2	8
54	RESERVED:ASSIGNMENT_RHS:REMOVED:true:2	7	2	1	6
55	RESERVED:CONDITION:INSERTED:null:1 RESERVED:CONDITION:INSERTED:typeof:1	20	1	2	16
56	RESERVED:ASSIGNMENT_RHS:REMOVED:false:1 RESERVED:ASSIGNMENT_RHS:INSERTED:true:1	13	1	2	9
57	RESERVED:METHOD_CALL:REMOVED:this:1	28	1	1	16
58	RESERVED:ARGUMENT:REMOVED:null:1	13	1	1	10
59	RESERVED:CONDITION:INSERTED:falsey:3	23	3	1	18
60	RESERVED:ARGUMENT:REMOVED:error:1	20	1	1	10
61	METHOD:METHOD_CALL:INSERTED:push:1	11	1	1	7
62	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:ASSIGNMENT_RHS:INSERTED:this:1	10	1	2	6
63	RESERVED:ASSIGNMENT_RHS:REMOVED:null:1 RESERVED:STATEMENT:UPDATED:var:1	6	1	2	1
64	RESERVED:STATEMENT:INSERTED:try:1 RESERVED:EXCEPTION_CATCH:INSERTED:error:1	44	3	2	23
65	RESERVED:ASSIGNMENT_RHS:INSERTED:false:1 RESERVED:STATEMENT:UPDATED:var:1	13	1	2	10
66	RESERVED:ARGUMENT:INSERTED:null:2	6	1	1	5
67	RESERVED:CONDITION:REMOVED:typeof:1 RESERVED:CONDITION:REMOVED:sheq:1	11	1	2	11
68	RESERVED:ASSIGNMENT_LHS:REMOVED:this:1	18	1	1	12
69	FIELD:ASSIGNMENT_LHS:INSERTED:1	9	1	1	7
70	RESERVED:ARGUMENT:INSERTED:null:1 RESERVED:STATEMENT:UPDATED:return:1	10	1	2	8
71	RESERVED:ASSIGNMENT_RHS:INSERTED:true:2 RESERVED:STATEMENT:UPDATED:var:1	5	1	2	2
72	RESERVED:STATEMENT:REMOVED:return:1 RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:REMOVED:falsey:1	5	2	3	5
73	RESERVED:CONDITION:REMOVED:falsey:2	34	2	1	18
74	FIELD:ASSIGNMENT_LHS:INSERTED:prototype:1	67	3	1	24
75	RESERVED:CONDITION:INSERTED:falsey:2 RESERVED:STATEMENT:UPDATED:var:1	33	3	2	21
76	RESERVED:STATEMENT:UPDATED:return:1 METHOD:METHOD_CALL:INSERTED:replace:1	16	1	2	11
77	RESERVED:CONDITION:INSERTED:eq:1	49	2	1	19
78	RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:UPDATED:var:1	6	3	3	5
79	RESERVED:ARGUMENT:REMOVED:true:1	13	1	1	10
80	RESERVED:ASSIGNMENT_LHS:INSERTED:this:1 RESERVED:CONDITION:INSERTED:falsey:1	5	2	2	5
81	RESERVED:ARGUMENT:INSERTED:this:1	31	1	1	17
82	RESERVED:ARGUMENT:INSERTED:null:1	23	1	1	15
83	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:INSERTED:typeof:1	14	3	3	12
84	METHOD:METHOD_CALL:INSERTED:String:1	6	1	1	4

#	Description				
85	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:STATEMENT:UPDATED:var:1	19	2	2	12
86	RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:INSERTED:null:1 RESERVED:CONDITION:INSERTED:typeof:1	6	2	3	5
87	RESERVED:CONDITION:REMOVED:typeof:1	5	1	1	4
88	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:ASSIGNMENT_RHS:INSERTED:true:1	11	2	2	9
89	RESERVED:CONDITION:INSERTED:this:1	7	1	1	7
90	RESERVED:ASSIGNMENT_RHS:INSERTED:undefined:1	5	1	1	5
91	RESERVED:CONDITION:INSERTED:falsey:2 RESERVED:CONDITION:REMOVED:falsey:1	30	1	2	13
92	RESERVED:METHOD_CALL:INSERTED:this:1	83	1	1	29
93	METHOD:METHOD_CALL:REMOVED:replace:1	14	1	1	10
94	RESERVED:ASSIGNMENT_RHS:INSERTED:null:1	23	1	1	11
95	RESERVED:STATEMENT:REMOVED:return:1 RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:INSERTED:falsey:1	16	3	3	10
96	RESERVED:ASSIGNMENT_RHS:REMOVED:this:1 RESERVED:STATEMENT:REMOVED:var:1	5	1	2	5
97	FIELD:CONDITION:INSERTED:length:1	23	1	1	15
98	RESERVED:CONDITION:INSERTED:falsey:4	5	4	1	5
99	RESERVED:CONDITION:INSERTED:eq:1 RESERVED:CONDITION:INSERTED:typeof:1	20	1	2	12
100	RESERVED:ASSIGNMENT_RHS:REMOVED:null:1	13	1	1	10
101	RESERVED:CONDITION:INSERTED:falsey:2 RESERVED:STATEMENT:UPDATED:var:2	8	2	2	5
102	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:ASSIGNMENT_RHS:INSERTED:null:1	8	2	2	6
103	RESERVED:CONDITION:REMOVED:falsey:2 RESERVED:STATEMENT:UPDATED:var:1	6	1	2	5
104	METHOD:METHOD_CALL:INSERTED:indexOf:1	11	1	1	7
105	RESERVED:METHOD_CALL:REMOVED:error:1	13	1	1	7
106	RESERVED:STATEMENT:UPDATED:var:1 METHOD:METHOD_CALL:INSERTED:toLowerCase:1	7	1	2	6
107	METHOD:METHOD_CALL:INSERTED:forEach:1	9	5	1	8
108	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:REMOVED:eq:1	22	1	2	16
109	RESERVED:STATEMENT:UPDATED:return:1 METHOD:METHOD_CALL:INSERTED:toLowerCase:1	5	1	2	3
110	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:REMOVED:falsey:1 RESERVED:STATEMENT:UPDATED:return:1	8	1	3	7
111	RESERVED:CONDITION:REMOVED:typeof:1 RESERVED:CONDITION:REMOVED:undefined:1 RESERVED:CONDITION:INSERTED:undefined:1 RESERVED:CONDITION:INSERTED:typeof:1	5	1	4	3
112	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:REMOVED:sheq:1	11	1	2	10
113	RESERVED:ASSIGNMENT_RHS:REMOVED:true:1 RESERVED:ASSIGNMENT_RHS:INSERTED:true:1	5	2	2	4
114	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:STATEMENT:INSERTED:var:1	11	3	2	9
115	RESERVED:STATEMENT:REMOVED:return:1 RESERVED:CONDITION:REMOVED:falsey:1	12	2	2	9

116	RESERVED:ASSIGNMENT_RHS:INSERTED:true:1 RESERVED:STATEMENT:UPDATED:var:1	30	1	2	13
117	RESERVED:ASSIGNMENT_LHS:INSERTED:this:1 RESERVED:ASSIGNMENT_RHS:INSERTED:this:1	8	1	2	6
118	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:REMOVED:falsey:1 RESERVED:STATEMENT:UPDATED:var:1	15	3	3	11
119	RESERVED:CONDITION:REMOVED:falsey:1 RESERVED:STATEMENT:UPDATED:var:1	23	2	2	18
120	RESERVED:CONDITION:REMOVED:falsey:1 RESERVED:CONDITION:INSERTED:null:1 RESERVED:CONDITION:INSERTED:typeof:1	5	1	3	5
121	RESERVED:ARGUMENT:INSERTED:true:2	7	2	1	5
122	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:INSERTED:true:1	7	1	2	6
123	METHOD:METHOD_CALL:INSERTED:toString:1	8	1	1	7
124	RESERVED:ARGUMENT:INSERTED:false:1	11	2	1	6
125	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:STATEMENT:UPDATED:return:1	6	1	2	4
126	METHOD:METHOD_CALL:INSERTED:map:1	6	3	1	6
127	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:CONDITION:INSERTED:falsey:2	20	3	2	11
128	RESERVED:CONDITION:INSERTED:eq:1 RESERVED:CONDITION:REMOVED:sheq:1	14	1	2	9
129	METHOD:METHOD_CALL:REMOVED:bind:1	5	4	1	4
130	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:INSERTED:falsey:2	7	1	2	7
131	RESERVED:CONDITION:INSERTED:sheq:1 METHOD:METHOD_CALL:INSERTED:indexOf:1	5	1	2	4
132	RESERVED:ARGUMENT:INSERTED:undefined:1	5	1	1	5
133	RESERVED:ASSIGNMENT_RHS:INSERTED:null:2	6	2	1	4
134	RESERVED:ARGUMENT:INSERTED:error:1	18	1	1	15
135	RESERVED:CONDITION:REMOVED:falsey:1 RESERVED:STATEMENT:REMOVED:var:1	8	2	2	6
136	RESERVED:CONDITION:REMOVED:falsey:1 RESERVED:STATEMENT:UPDATED:return:1	6	1	2	5
137	RESERVED:EXPRESSION:INSERTED:this:1	6	1	1	6
138	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:UPDATED:falsey:1	7	1	2	6
139	RESERVED:STATEMENT:UPDATED:var:1	19	2	1	6
140	RESERVED:METHOD_CALL:INSERTED:this:2	10	2	1	7
141	RESERVED:ARGUMENT:INSERTED:this:1 METHOD:METHOD_CALL:INSERTED:bind:1	9	1	2	6
142	RESERVED:ASSIGNMENT_RHS:INSERTED:true:1 RESERVED:ASSIGNMENT_RHS:INSERTED:false:1	6	1	2	6
143	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:REMOVED:falsey:2	7	2	2	5
144	RESERVED:CONDITION:INSERTED:eq:2	6	1	1	2
145	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:UPDATED:new:1	6	1	2	6
146	RESERVED:CONDITION:REMOVED:eq:1	13	2	1	9
147	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:ASSIGNMENT_RHS:INSERTED:this:1	6	5	2	5
148	RESERVED:CONDITION:INSERTED:eq:1 RESERVED:CONDITION:INSERTED:falsey:1	5	2	2	4

149	METHOD:METHOD_CALL:INSERTED:slice:1	10	1	1	8
150	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:INSERTED:callback:1	8	1	2	6
151	RESERVED:STATEMENT:INSERTED:new:1 RESERVED:CONDITION:INSERTED:falsey:1	8	2	2	6
152	RESERVED:ARGUMENT:INSERTED:error:1	5	5	1	4
153	METHOD:METHOD_CALL:INSERTED:toLowerCase:1	12	1	1	6
154	RESERVED:CONDITION:INSERTED:falsey:2 RESERVED:CONDITION:REMOVED:falsey:2	7	2	2	6
155	FIELD:ASSIGNMENT_LHS:REMOVED:prototype:1	9	4	1	9
156	RESERVED:STATEMENT:UPDATED:var:1 METHOD:METHOD_CALL:INSERTED:replace:1	15	1	2	11
157	RESERVED:METHOD_CALL:INSERTED:this:1 RESERVED:CONDITION:INSERTED:falsey:1	7	2	2	7
158	RESERVED:STATEMENT:INSERTED:return:2 RESERVED:CONDITION:INSERTED:falsey:2	7	4	2	7
159	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:INSERTED:undefined:1 RESERVED:CONDITION:INSERTED:typeof:1	5	1	3	5
160	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:REMOVED:eq:1 RESERVED:STATEMENT:UPDATED:return:1	6	1	3	5
161	RESERVED:ASSIGNMENT_RHS:REMOVED:false:1 RESERVED:ASSIGNMENT_RHS:INSERTED:true:1 RESERVED:STATEMENT:UPDATED:var:1	5	1	3	5
162	RESERVED:CONDITION:INSERTED:sheq:2 RESERVED:CONDITION:INSERTED:typeof:2	9	1	2	8
163	RESERVED:PARAMETER_DECLARATION:REMOVED:callback:1	6	1	1	5
164	RESERVED:CONDITION:INSERTED:false:1 RESERVED:ASSIGNMENT_LHS:INSERTED:this:1 RESERVED:CONDITION:INSERTED:falsey:1	5	1	3	4
165	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:INSERTED:this:1	5	1	2	5
166	RESERVED:CONDITION:REMOVED:falsey:2	6	6	1	6
167	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:ASSIGNMENT_RHS:INSERTED:true:1 RESERVED:ASSIGNMENT_RHS:INSERTED:false:1	8	3	4	8
168	METHOD:METHOD_CALL:INSERTED:push:1 RESERVED:CONDITION:INSERTED:falsey:1	5	2	2	4
169	RESERVED:METHOD_CALL:INSERTED:callback:1 RESERVED:STATEMENT:INSERTED:return:1 RESERVED:ARGUMENT:INSERTED:null:1 RESERVED:CONDITION:INSERTED:falsey:1	6	2	4	4
170	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:UPDATED:var:2	5	5	2	5
171	FIELD:CONDITION:INSERTED:length:1 RESERVED:CONDITION:INSERTED:typeof:1	13	1	2	11
172	RESERVED:CONDITION:INSERTED:falsey:1 METHOD:METHOD_CALL:INSERTED:hasOwnProperty:1	9	1	2	7
173	RESERVED:ASSIGNMENT_RHS:REMOVED:this:1	6	1	1	6
174	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:INSERTED:typeof:1	9	2	3	8

175	RESERVED:METHOD_CALL:INSERTED:this:1 RESERVED:STATEMENT:INSERTED:new:1	5	4	2	2
176	RESERVED:CONDITION:INSERTED:falsey:4	8	1	1	8
177	METHOD:METHOD_CALL:INSERTED:concat:1	6	1	1	6
178	RESERVED:CONDITION:REMOVED:typeof:1 RESERVED:CONDITION:REMOVED:undefined:1	6	1	2	4
179	RESERVED:CONDITION:REMOVED:typeof:1 RESERVED:CONDITION:INSERTED:typeof:1	10	1	2	6
180	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:INSERTED:error:1	12	1	2	11
181	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:REMOVED:falsey:1 RESERVED:CONDITION:INSERTED:typeof:1	5	1	3	5
182	METHOD:METHOD_CALL:INSERTED:trim:1	8	1	1	7
183	RESERVED:CONDITION:INSERTED:false:2 RESERVED:CONDITION:INSERTED:sheq:2	5	2	2	4
184	RESERVED:CONDITION:INSERTED:falsey:2 RESERVED:STATEMENT:UPDATED:return:1	9	2	2	7
185	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:ASSIGNMENT_RHS:INSERTED:false:1	13	2	2	7
186	RESERVED:STATEMENT:INSERTED:return:1	5	2	1	5
187	METHOD:METHOD_CALL:INSERTED:call:1 RESERVED:METHOD_CALL:UPDATED:delete:1	6	1	2	1
188	RESERVED:METHOD_CALL:INSERTED:this:1 FIELD:ASSIGNMENT_LHS:INSERTED:prototype:1	5	4	2	5
189	RESERVED:ARGUMENT:INSERTED:null:1	5	5	1	5
190	RESERVED:CONDITION:INSERTED:eq:1 METHOD:METHOD_CALL:INSERTED:indexOf:1 RESERVED:CONDITION:INSERTED:typeof:1	5	2	3	1
191	RESERVED:ASSIGNMENT_LHS:INSERTED:this:1 RESERVED:ASSIGNMENT_RHS:INSERTED:null:1	8	1	2	4
192	RESERVED:ARGUMENT:INSERTED:true:1 RESERVED:CONDITION:INSERTED:falsey:1	5	2	2	3
193	METHOD:METHOD_CALL:INSERTED:match:1 RESERVED:CONDITION:INSERTED:falsey:1	6	1	2	6
194	RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:INSERTED:typeof:1	6	2	2	6
195	METHOD:METHOD_CALL:REMOVED:forEach:1 METHOD:METHOD_CALL:INSERTED:forEach:1	13	2	2	2
196	RESERVED:STATEMENT:INSERTED:return:1 RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:UPDATED:return:1	6	4	3	5
197	RESERVED:ASSIGNMENT_RHS:REMOVED:true:1 RESERVED:ASSIGNMENT_RHS:INSERTED:false:1	18	1	2	10
198	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:CONDITION:INSERTED:falsey:2 RESERVED:STATEMENT:UPDATED:var:1	6	2	3	5
199	RESERVED:CONDITION:INSERTED:sheq:2 RESERVED:CONDITION:INSERTED:typeof:2	5	4	2	4
200	RESERVED:CONDITION:REMOVED:falsey:3	5	3	1	4
201	RESERVED:ARGUMENT:INSERTED:typeof:1	5	1	1	4
202	RESERVED:CONDITION:INSERTED:false:1 RESERVED:CONDITION:INSERTED:sheq:1	11	1	2	9
203	RESERVED:ASSIGNMENT_RHS:REMOVED:true:1 RESERVED:STATEMENT:UPDATED:var:1	7	1	2	5

204	RESERVED:STATEMENT:INSERTED:var:1 RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:UPDATED:return:1	5	2	3	5
205	METHOD:METHOD_CALL:INSERTED:sort:1	5	3	1	4
206	RESERVED:CONDITION:REMOVED:sheq:2	8	2	1	8
207	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:INSERTED:typeof:1 RESERVED:STATEMENT:UPDATED:var:1	7	1	3	5
208	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:METHOD_CALL:INSERTED:error:1	6	2	2	4
209	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:ASSIGNMENT_RHS:INSERTED:true:1 RESERVED:ASSIGNMENT_RHS:INSERTED:false:1 RESERVED:STATEMENT:UPDATED:var:1	5	3	4	3
210	RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:INSERTED:null:1 RESERVED:CONDITION:INSERTED:typeof:1	5	2	3	5
211	RESERVED:ARGUMENT:INSERTED:error:1 RESERVED:STATEMENT:INSERTED:try:1 RESERVED:EXCEPTION_CATCH:INSERTED:error:1	5	3	3	5
212	RESERVED:CONDITION:INSERTED:eq:1 RESERVED:CONDITION:REMOVED:eq:1	6	1	2	6
213	METHOD:METHOD_CALL:INSERTED:split:1	5	1	1	4
214	RESERVED:STATEMENT:INSERTED:var:2 RESERVED:CONDITION:INSERTED:falsey:1	5	5	2	5
215	RESERVED:CONDITION:INSERTED:sheq:1 RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:CONDITION:REMOVED:falsey:1	6	1	3	3
216	RESERVED:CONDITION:INSERTED:false:1 RESERVED:CONDITION:INSERTED:falsey:1 RESERVED:STATEMENT:UPDATED:var:1	5	1	3	2
217	RESERVED:ASSIGNMENT_RHS:INSERTED:true:1 RESERVED:STATEMENT:UPDATED:return:1	5	1	2	3
218	METHOD:METHOD_CALL:REMOVED:replace:1 RESERVED:STATEMENT:UPDATED:return:1	6	1	2	6
219	RESERVED:METHOD_CALL:INSERTED:callback:1	5	2	1	3

4 List of Basic Change Types

Table 3 lists the basic change types identified by BUGAID in our empirical study.

Table 3: Basic Change Types

ID	Type	Context	Modification	Name	#
1	BEHAVIOUR	CONDITION	INSERTED	falsey	4041
2	RESERVED	STATEMENT	UPDATED	var	2208
3	RESERVED	STATEMENT	INSERTED	var	1644
4	BEHAVIOUR	CONDITION	REMOVED	falsey	1487
5	RESERVED	CONDITION	INSERTED	sheq	1471
6	RESERVED	STATEMENT	INSERTED	return	1123
7	RESERVED	CONDITION	INSERTED	typeof	1075
8	RESERVED	STATEMENT	UPDATED	return	1002

9	RESERVED	ASSIGNMENT_RHS	INSERTED	true	673
10	RESERVED	STATEMENT	REMOVED	var	610
11	RESERVED	CONDITION	REMOVED	sheq	562
12	RESERVED	STATEMENT	REMOVED	return	532
13	RESERVED	CONDITION	INSERTED	eq	469
14	RESERVED	ASSIGNMENT_RHS	INSERTED	false	429
15	RESERVED	METHOD_CALL	INSERTED	this	414
16	RESERVED	CONDITION	REMOVED	typeof	408
17	RESERVED	ASSIGNMENT_LHS	INSERTED	this	373
18	RESERVED	STATEMENT	INSERTED	new	364
19	RESERVED	ARGUMENT	INSERTED	this	305
20	BEHAVIOUR	CONDITION	UPDATED	falsey	275
21	METHOD	METHOD_CALL	INSERTED	replace	269
22	RESERVED	ASSIGNMENT_RHS	REMOVED	true	267
23	RESERVED	CONDITION	INSERTED	null	266
24	RESERVED	CONDITION	REMOVED	eq	258
25	METHOD	METHOD_CALL	INSERTED	test	255
26	RESERVED	STATEMENT	UPDATED	new	249
27	FIELD	CONDITION	INSERTED	length	244
28	CONVENTION	ARGUMENT	INSERTED	error	226
29	RESERVED	ASSIGNMENT_RHS	INSERTED	null	226
30	RESERVED	ARGUMENT	INSERTED	null	221
31	METHOD	METHOD_CALL	INSERTED	indexOf	217
32	CONVENTION	METHOD_CALL	INSERTED	callback	215
33	RESERVED	CONDITION	INSERTED	undefined	195
34	RESERVED	ASSIGNMENT_RHS	INSERTED	this	186
35	CONVENTION	CONDITION	INSERTED	error	182
36	RESERVED	ARGUMENT	INSERTED	true	173
37	RESERVED	CONDITION	INSERTED	this	173
38	RESERVED	ASSIGNMENT_RHS	REMOVED	false	172
39	RESERVED	STATEMENT	INSERTED	try	170
40	RESERVED	ARGUMENT	REMOVED	this	164
41	CONVENTION	EXCEPTION_CATCH	INSERTED	error	157
42	FIELD	ASSIGNMENT_LHS	INSERTED	prototype	156
43	RESERVED	METHOD_CALL	REMOVED	this	154
44	CONVENTION	METHOD_CALL	INSERTED	error	148
45	RESERVED	CONDITION	INSERTED	false	144
46	RESERVED	STATEMENT	REMOVED	new	138
47	RESERVED	CONDITION	UPDATED	sheq	137
48	RESERVED	ARGUMENT	REMOVED	null	116
49	METHOD	METHOD_CALL	INSERTED	match	114
50	CONVENTION	ARGUMENT	REMOVED	error	111
51	RESERVED	ASSIGNMENT_LHS	REMOVED	this	108
52	RESERVED	CONDITION	REMOVED	null	106
53	METHOD	METHOD_CALL	INSERTED	push	103
54	METHOD	METHOD_CALL	INSERTED	split	103
55	METHOD	METHOD_CALL	INSERTED	toString	100
56	CONVENTION	ASSIGNMENT_LHS	INSERTED	error	100
57	CLASS	METHOD_CALL	INSERTED	Object	96
58	METHOD	METHOD_CALL	INSERTED	call	94
59	METHOD	METHOD_CALL	INSERTED	slice	91
60	CONVENTION	ARGUMENT	INSERTED	callback	91
61	RESERVED	ASSIGNMENT_RHS	REMOVED	null	89
62	RESERVED	ARGUMENT	INSERTED	false	88

63	RESERVED	CONDITION	REMOVED	undefined	85
64	METHOD	METHOD_CALL	REMOVED	replace	84
65	METHOD	METHOD_CALL	INSERTED	toLowerCase	82
66	METHOD	METHOD_CALL	REMOVED	indexOf	79
67	RESERVED	ARGUMENT	REMOVED	true	79
68	FIELD	EXPRESSION	INSERTED	length	77
69	METHOD	METHOD_CALL	INSERTED	keys	76
70	CLASS	METHOD_CALL	INSERTED	JSON	75
71	METHOD	METHOD_CALL	INSERTED	bind	75
72	METHOD	METHOD_CALL	INSERTED	forEach	72
73	RESERVED	EXPRESSION	INSERTED	this	71
74	CONVENTION	METHOD_CALL	REMOVED	callback	70
75	RESERVED	STATEMENT	INSERTED	break	70
76	RESERVED	ASSIGNMENT_RHS	REMOVED	this	69
77	FIELD	CONDITION	REMOVED	length	68
78	CONVENTION	CONDITION	INSERTED	callback	68
79	CONVENTION	CONDITION	REMOVED	error	66
80	METHOD	METHOD_CALL	INSERTED	concat	60
81	METHOD	METHOD_CALL	INSERTED	map	60
82	METHOD	METHOD_CALL	INSERTED	stringify	59
83	METHOD	METHOD_CALL	INSERTED	parseInt	58
84	FIELD	CONDITION	INSERTED	name	57
85	METHOD	METHOD_CALL	INSERTED	parse	57
86	CLASS	METHOD_CALL	INSERTED	Math	56
87	RESERVED	CONDITION	INSERTED	true	56
88	CONVENTION	METHOD_CALL	REMOVED	error	56
89	METHOD	METHOD_CALL	REMOVED	call	52
90	RESERVED	CONDITION	UPDATED	eq	52
91	METHOD	METHOD_CALL	INSERTED	filter	51
92	METHOD	METHOD_CALL	INSERTED	trim	51
93	CONVENTION	EXPRESSION	INSERTED	error	51
94	METHOD	METHOD_CALL	REMOVED	test	48
95	RESERVED	CONDITION	UPDATED	typeof	48
96	RESERVED	CONDITION	REMOVED	this	47
97	CONVENTION	ARGUMENT	REMOVED	callback	43
98	RESERVED	ASSIGNMENT_RHS	INSERTED	undefined	43
99	RESERVED	STATEMENT	REMOVED	break	43
100	CLASS	METHOD_CALL	INSERTED	Array	42
101	CONVENTION	ASSIGNMENT_LHS	INSERTED	callback	42
102	RESERVED	STATEMENT	REMOVED	try	41
103	CLASS	METHOD_CALL	REMOVED	JSON	40
104	FIELD	METHOD_CALL	INSERTED	prototype	40
105	METHOD	METHOD_CALL	REMOVED	push	40
106	CONVENTION	PARAMETER_DECLARATION	INSERTED	error	40
107	RESERVED	ARGUMENT	INSERTED	undefined	38
108	FIELD	ASSIGNMENT_LHS	REMOVED	prototype	37
109	METHOD	METHOD_CALL	INSERTED	hasOwnProperty	37
110	RESERVED	CONDITION	REMOVED	false	37
111	RESERVED	EXPRESSION	REMOVED	this	37
112	RESERVED	STATEMENT	INSERTED	continue	36
113	FIELD	ASSIGNMENT_RHS	INSERTED	length	35
114	METHOD	METHOD_CALL	INSERTED	substr	35
115	METHOD	METHOD_CALL	REMOVED	stringify	35
116	RESERVED	ARGUMENT	REMOVED	false	35

117	METHOD	METHOD_CALL	REMOVED	toString	34
118	CONVENTION	EXCEPTION_CATCH	REMOVED	error	34
119	FIELD	EXPRESSION	INSERTED	name	33
120	METHOD	METHOD_CALL	INSERTED	charAt	33
121	METHOD	METHOD_CALL	REMOVED	forEach	33
122	RESERVED	ARGUMENT	REMOVED	arguments	33
123	CONVENTION	PARAMETER_DECLARATION	INSERTED	callback	33
124	CLASS	METHOD_CALL	REMOVED	Object	32
125	METHOD	METHOD_CALL	INSERTED	String	32
126	METHOD	METHOD_CALL	REMOVED	split	32
127	FIELD	EXPRESSION	REMOVED	length	31
128	METHOD	METHOD_CALL	INSERTED	exec	31
129	METHOD	METHOD_CALL	REMOVED	bind	31
130	METHOD	METHOD_CALL	REMOVED	match	31
131	FIELD	ASSIGNMENT_RHS	REMOVED	length	30
132	METHOD	METHOD_CALL	INSERTED	apply	30
133	CONVENTION	ASSIGNMENT_LHS	REMOVED	error	30
134	FIELD	ASSIGNMENT_LHS	INSERTED	29	
135	FIELD	ASSIGNMENT_RHS	INSERTED	prototype	29
136	METHOD	METHOD_CALL	REMOVED	keys	29
137	CONVENTION	ASSIGNMENT_RHS	INSERTED	error	29
138	RESERVED	CONDITION	REMOVED	true	29
139	METHOD	METHOD_CALL	INSERTED	isNaN	28
140	METHOD	METHOD_CALL	INSERTED	substring	28
141	RESERVED	ASSIGNMENT_RHS	REMOVED	undefined	28
142	METHOD	METHOD_CALL	INSERTED	create	27
143	METHOD	METHOD_CALL	REMOVED	slice	27
144	FIELD	EXPRESSION	INSERTED	message	26
145	METHOD	METHOD_CALL	REMOVED	concat	26
146	RESERVED	ARGUMENT	INSERTED	arguments	26
147	CONVENTION	VARIABLE_DECLARATION	INSERTED	error	26
148	CLASS	METHOD_CALL	REMOVED	Math	25
149	FIELD	ASSIGNMENT_RHS	INSERTED	name	25
150	CONVENTION	EXPRESSION	REMOVED	error	25
151	CLASS	METHOD_CALL	INSERTED	Date	24
152	FIELD	EXPRESSION	REMOVED	name	24
153	METHOD	METHOD_CALL	INSERTED	sort	24
154	METHOD	METHOD_CALL	INSERTED	getTime	23
155	METHOD	METHOD_CALL	REMOVED	toLowerCase	23
156	RESERVED	CONDITION	INSERTED	arguments	23
157	METHOD	METHOD_CALL	INSERTED	is	22
158	METHOD	METHOD_CALL	INSERTED	toUpperCase	22
159	METHOD	METHOD_CALL	REMOVED	parseInt	21
160	CONVENTION	PARAMETER_DECLARATION	REMOVED	error	21
161	METHOD	METHOD_CALL	INSERTED	max	19
162	METHOD	METHOD_CALL	INSERTED	min	19
163	FIELD	METHOD_CALL	REMOVED	prototype	18
164	METHOD	METHOD_CALL	REMOVED	parse	18
165	METHOD	METHOD_CALL	REMOVED	trim	18
166	RESERVED	ARGUMENT	INSERTED	typeof	18
167	METHOD	METHOD_CALL	INSERTED	defineProperty	17
168	METHOD	METHOD_CALL	INSERTED	unshift	17
169	METHOD	METHOD_CALL	UPDATED	test	17
170	FIELD	ASSIGNMENT_LHS	INSERTED	message	16

171	FIELD	ASSIGNMENT_RHS	REMOVED	prototype	16
172	FIELD	CONDITION	INSERTED	16	
173	FIELD	METHOD_CALL	INSERTED	16	
174	METHOD	METHOD_CALL	INSERTED	encodeURIComponent	16
175	METHOD	METHOD_CALL	REMOVED	map	16
176	RESERVED	CONDITION	INSERTED	new	16
177	CONVENTION	PARAMETER_DECLARATION	REMOVED	callback	16
178	METHOD	METHOD_CALL	INSERTED	Number	15
179	METHOD	METHOD_CALL	INSERTED	pop	15
180	METHOD	METHOD_CALL	REMOVED	apply	15
181	METHOD	METHOD_CALL	REMOVED	charAt	15
182	METHOD	METHOD_CALL	REMOVED	exec	15
183	METHOD	METHOD_CALL	UPDATED	match	15
184	CONVENTION	VARIABLE_DECLARATION	REMOVED	error	15
185	CLASS	METHOD_CALL	REMOVED	Date	14
186	FIELD	CONDITION	REMOVED	name	14
187	METHOD	METHOD_CALL	UPDATED	replace	14
188	CONVENTION	ASSIGNMENT_RHS	REMOVED	error	14
189	RESERVED	METHOD_CALL	INSERTED	catch	14
190	RESERVED	STATEMENT	REMOVED	continue	14
191	FIELD	ASSIGNMENT_LHS	INSERTED	name	13
192	METHOD	METHOD_CALL	INSERTED	shift	13
193	METHOD	METHOD_CALL	REMOVED	pop	13
194	RESERVED	ASSIGNMENT_LHS	INSERTED	default	13
195	FIELD	CONDITION	INSERTED	message	12
196	METHOD	METHOD_CALL	INSERTED	lastIndexOf	12
197	METHOD	METHOD_CALL	REMOVED	String	12
198	METHOD	METHOD_CALL	UPDATED	split	12
199	RESERVED	ARGUMENT	REMOVED	undefined	12
200	FIELD	ASSIGNMENT_RHS	INSERTED	message	11
201	FIELD	CONDITION	INSERTED	constructor	11
202	FIELD	METHOD_CALL	INSERTED	message	11
203	FIELD	METHOD_CALL	INSERTED	name	11
204	METHOD	METHOD_CALL	INSERTED	decodeURIComponent	11
205	METHOD	METHOD_CALL	INSERTED	random	11
206	METHOD	METHOD_CALL	INSERTED	reduce	11
207	METHOD	METHOD_CALL	INSERTED	splice	11
208	METHOD	METHOD_CALL	REMOVED	filter	11
209	METHOD	METHOD_CALL	REMOVED	unshift	11
210	METHOD	METHOD_CALL	UPDATED	filter	11
211	METHOD	METHOD_CALL	UPDATED	indexOf	11
212	RESERVED	ASSIGNMENT_LHS	INSERTED	package	11
213	CONVENTION	CONDITION	REMOVED	callback	11
214	RESERVED	METHOD_CALL	INSERTED	eval	11
215	CLASS	METHOD_CALL	UPDATED	Object	10
216	METHOD	METHOD_CALL	INSERTED	floor	10
217	METHOD	METHOD_CALL	INSERTED	parseFloat	10
218	METHOD	METHOD_CALL	REMOVED	hasOwnProperty	10
219	METHOD	METHOD_CALL	REMOVED	isNaN	10
220	METHOD	METHOD_CALL	REMOVED	substr	10
221	CONVENTION	ASSIGNMENT_LHS	REMOVED	callback	10
222	RESERVED	CONDITION	REMOVED	arguments	10
223	FIELD	ASSIGNMENT_RHS	INSERTED	9	
224	FIELD	CONDITION	UPDATED	length	9

225	METHOD	METHOD_CALL	INSERTED	valueOf	9
226	METHOD	METHOD_CALL	UPDATED	map	9
227	RESERVED	ASSIGNMENT_LHS	INSERTED	eval	9
228	CONVENTION	METHOD_CALL	UPDATED	error	9
229	FIELD	ASSIGNMENT_LHS	INSERTED	length	8
230	FIELD	ASSIGNMENT_LHS	REMOVED	message	8
231	FIELD	ASSIGNMENT_RHS	REMOVED	name	8
232	METHOD	METHOD_CALL	INSERTED	compile	8
233	METHOD	METHOD_CALL	REMOVED	getTime	8
234	METHOD	METHOD_CALL	REMOVED	random	8
235	METHOD	METHOD_CALL	REMOVED	shift	8
236	METHOD	METHOD_CALL	REMOVED	sort	8
237	METHOD	METHOD_CALL	UPDATED	concat	8
238	METHOD	METHOD_CALL	UPDATED	slice	8
239	RESERVED	ASSIGNMENT_LHS	INSERTED	class	8
240	RESERVED	CONDITION	INSERTED	package	8
241	RESERVED	METHOD_CALL	REMOVED	catch	8
242	RESERVED	STATEMENT	UPDATED	try	8
243	CLASS	METHOD_CALL	UPDATED	JSON	7
244	FIELD	CONDITION	REMOVED	constructor	7
245	FIELD	CONDITION	REMOVED	message	7
246	METHOD	METHOD_CALL	INSERTED	isFinite	7
247	METHOD	METHOD_CALL	INSERTED	some	7
248	METHOD	METHOD_CALL	INSERTED	toJSON	7
249	METHOD	METHOD_CALL	INSERTED	unescape	7
250	METHOD	METHOD_CALL	REMOVED	encodeURIComponent	7
251	METHOD	METHOD_CALL	REMOVED	parseFloat	7
252	METHOD	METHOD_CALL	UPDATED	stringify	7
253	RESERVED	ARGUMENT	REMOVED	typeof	7
254	RESERVED	CONDITION	REMOVED	new	7
255	RESERVED	METHOD_CALL	INSERTED	export	7
256	RESERVED	METHOD_CALL	UPDATED	delete	7
257	FIELD	ASSIGNMENT_LHS	REMOVED	name	6
258	FIELD	EXPRESSION	INSERTED	source	6
259	FIELD	EXPRESSION	UPDATED	length	6
260	METHOD	METHOD_CALL	INSERTED	abs	6
261	METHOD	METHOD_CALL	REMOVED	Number	6
262	METHOD	METHOD_CALL	REMOVED	defineProperty	6
263	RESERVED	ARGUMENT	INSERTED	package	6
264	RESERVED	ASSIGNMENT_RHS	INSERTED	default	6
265	RESERVED	CONDITION	UPDATED	new	6
266	RESERVED	METHOD_CALL	INSERTED	static	6
267	CONVENTION	VARIABLE_DECLARATION	INSERTED	callback	6
268	CLASS	ARGUMENT	INSERTED	JSON	5
269	CLASS	METHOD_CALL	REMOVED	Array	5
270	FIELD	ASSIGNMENT_LHS	INSERTED	source	5
271	FIELD	CONDITION	REMOVED	5	
272	METHOD	ARGUMENT	INSERTED	stringify	5
273	METHOD	METHOD_CALL	INSERTED	round	5
274	METHOD	METHOD_CALL	REMOVED	decodeURIComponent	5
275	METHOD	METHOD_CALL	REMOVED	lastIndexOf	5
276	METHOD	METHOD_CALL	REMOVED	max	5
277	METHOD	METHOD_CALL	REMOVED	splice	5
278	METHOD	METHOD_CALL	REMOVED	toUpperCase	5

279	CONVENTION	ARGUMENT	UPDATED	error	5
280	RESERVED	ASSIGNMENT_LHS	REMOVED	default	5
281	RESERVED	ASSIGNMENT_LHS	REMOVED	eval	5
282	RESERVED	ASSIGNMENT_LHS	REMOVED	package	5
283	CLASS	METHOD_CALL	INSERTED	Error	4
284	CLASS	METHOD_CALL	REMOVED	String	4
285	FIELD	ARGUMENT	INSERTED	prototype	4
286	FIELD	CONDITION	INSERTED	prototype	4
287	FIELD	CONDITION	INSERTED	source	4
288	FIELD	EXPRESSION	INSERTED	constructor	4
289	FIELD	EXPRESSION	INSERTED	4	
290	FIELD	EXPRESSION	REMOVED	message	4
291	METHOD	METHOD_CALL	INSERTED	encodeURI	4
292	METHOD	METHOD_CALL	INSERTED	localeCompare	4
293	METHOD	METHOD_CALL	INSERTED	pow	4
294	METHOD	METHOD_CALL	INSERTED	reverse	4
295	METHOD	METHOD_CALL	INSERTED	toFixed	4
296	METHOD	METHOD_CALL	INSERTED	toUTCString	4
297	METHOD	METHOD_CALL	REMOVED	is	4
298	METHOD	METHOD_CALL	REMOVED	reduce	4
299	METHOD	METHOD_CALL	REMOVED	round	4
300	METHOD	METHOD_CALL	REMOVED	substring	4
301	METHOD	METHOD_CALL	REMOVED	valueOf	4
302	METHOD	METHOD_CALL	UPDATED	apply	4
303	METHOD	METHOD_CALL	UPDATED	charAt	4
304	METHOD	METHOD_CALL	UPDATED	push	4
305	METHOD	METHOD_CALL	UPDATED	sort	4
306	METHOD	METHOD_CALL	UPDATED	toLowerCase	4
307	RESERVED	METHOD_CALL	INSERTED	boolean	4
308	RESERVED	METHOD_CALL	REMOVED	static	4
309	CONVENTION	VARIABLE_DECLARATION	REMOVED	callback	4
310	RESERVED	VARIABLE_DECLARATION	REMOVED	undefined	4
311	CLASS	METHOD_CALL	UPDATED	Array	3
312	FIELD	ARGUMENT	INSERTED	constructor	3
313	FIELD	ARGUMENT	INSERTED	source	3
314	FIELD	ASSIGNMENT_LHS	INSERTED	constructor	3
315	FIELD	ASSIGNMENT_LHS	REMOVED	constructor	3
316	FIELD	ASSIGNMENT_LHS	UPDATED	prototype	3
317	FIELD	ASSIGNMENT_RHS	REMOVED	3	
318	FIELD	ASSIGNMENT_RHS	REMOVED	message	3
319	FIELD	EXPRESSION	UPDATED	name	3
320	FIELD	METHOD_CALL	REMOVED	3	
321	FIELD	METHOD_CALL	UPDATED	prototype	3
322	METHOD	METHOD_CALL	INSERTED	charCodeAt	3
323	METHOD	METHOD_CALL	INSERTED	toISOString	3
324	METHOD	METHOD_CALL	REMOVED	compile	3
325	METHOD	METHOD_CALL	REMOVED	floor	3
326	METHOD	METHOD_CALL	REMOVED	fromCharCode	3
327	METHOD	METHOD_CALL	REMOVED	getDate	3
328	METHOD	METHOD_CALL	REMOVED	min	3
329	METHOD	METHOD_CALL	REMOVED	pow	3
330	METHOD	METHOD_CALL	REMOVED	toFixed	3
331	METHOD	METHOD_CALL	REMOVED	toJSON	3
332	METHOD	METHOD_CALL	UPDATED	forEach	3

333	METHOD	METHOD_CALL	UPDATED	lastIndexOf	3
334	METHOD	METHOD_CALL	UPDATED	shift	3
335	METHOD	METHOD_CALL	UPDATED	unshift	3
336	RESERVED	ARGUMENT	REMOVED	package	3
337	RESERVED	ASSIGNMENT_LHS	INSERTED	boolean	3
338	RESERVED	ASSIGNMENT_LHS	INSERTED	private	3
339	RESERVED	ASSIGNMENT_RHS	INSERTED	arguments	3
340	CONVENTION	ASSIGNMENT_RHS	INSERTED	callback	3
341	RESERVED	ASSIGNMENT_RHS	INSERTED	package	3
342	RESERVED	ASSIGNMENT_RHS	UPDATED	arguments	3
343	RESERVED	CONDITION	INSERTED	default	3
344	RESERVED	EXPRESSION	INSERTED	package	3
345	RESERVED	METHOD_CALL	INSERTED	function	3
346	RESERVED	METHOD_CALL	INSERTED	package	3
347	RESERVED	METHOD_CALL	INSERTED	throw	3
348	RESERVED	METHOD_CALL	REMOVED	boolean	3
349	RESERVED	METHOD_CALL	REMOVED	delete	3
350	RESERVED	METHOD_CALL	REMOVED	eval	3
351	RESERVED	VARIABLE_DECLARATION	INSERTED	undefined	3
352	CLASS	ARGUMENT	INSERTED	Error	2
353	CLASS	ARGUMENT	INSERTED	RegExp	2
354	CLASS	METHOD_CALL	INSERTED	String	2
355	CLASS	METHOD_CALL	REMOVED	Error	2
356	FIELD	ARGUMENT	REMOVED	constructor	2
357	FIELD	ARGUMENT	REMOVED	prototype	2
358	FIELD	ASSIGNMENT_LHS	INSERTED	lastIndex	2
359	FIELD	ASSIGNMENT_LHS	REMOVED	2	
360	FIELD	ASSIGNMENT_LHS	REMOVED	length	2
361	FIELD	ASSIGNMENT_RHS	INSERTED	constructor	2
362	FIELD	ASSIGNMENT_RHS	INSERTED	source	2
363	FIELD	ASSIGNMENT_RHS	UPDATED	length	2
364	FIELD	CONDITION	REMOVED	source	2
365	FIELD	CONDITION	UPDATED	prototype	2
366	FIELD	EXPRESSION	REMOVED	constructor	2
367	FIELD	METHOD_CALL	UPDATED	message	2
368	METHOD	ARGUMENT	INSERTED	create	2
369	METHOD	ARGUMENT	INSERTED	exec	2
370	METHOD	ARGUMENT	INSERTED	test	2
371	METHOD	METHOD_CALL	INSERTED	ceil	2
372	METHOD	METHOD_CALL	INSERTED	fromCharCode	2
373	METHOD	METHOD_CALL	INSERTED	getOwnPropertyNames	2
374	METHOD	METHOD_CALL	INSERTED	getUTCMinutes	2
375	METHOD	METHOD_CALL	INSERTED	setMilliseconds	2
376	METHOD	METHOD_CALL	INSERTED	toGMTString	2
377	METHOD	METHOD_CALL	REMOVED	UTC	2
378	METHOD	METHOD_CALL	REMOVED	abs	2
379	METHOD	METHOD_CALL	REMOVED	create	2
380	METHOD	METHOD_CALL	REMOVED	getFullYear	2
381	METHOD	METHOD_CALL	REMOVED	isFinite	2
382	METHOD	METHOD_CALL	REMOVED	reverse	2
383	METHOD	METHOD_CALL	REMOVED	some	2
384	METHOD	METHOD_CALL	REMOVED	toUTCString	2
385	METHOD	METHOD_CALL	UPDATED	call	2
386	METHOD	METHOD_CALL	UPDATED	exec	2

387	METHOD	METHOD_CALL	UPDATED	hasOwnProperty	2
388	METHOD	METHOD_CALL	UPDATED	keys	2
389	METHOD	METHOD_CALL	UPDATED	pop	2
390	METHOD	METHOD_CALL	UPDATED	round	2
391	METHOD	METHOD_CALL	UPDATED	toString	2
392	METHOD	METHOD_CALL	UPDATED	trim	2
393	RESERVED	ARGUMENT	INSERTED	default	2
394	RESERVED	ARGUMENT	UPDATED	arguments	2
395	RESERVED	ASSIGNMENT_LHS	INSERTED	arguments	2
396	RESERVED	ASSIGNMENT_LHS	INSERTED	else	2
397	RESERVED	ASSIGNMENT_LHS	INSERTED	in	2
398	RESERVED	ASSIGNMENT_LHS	INSERTED	int	2
399	RESERVED	ASSIGNMENT_LHS	INSERTED	long	2
400	RESERVED	ASSIGNMENT_LHS	INSERTED	short	2
401	RESERVED	ASSIGNMENT_LHS	INSERTED	yield	2
402	RESERVED	ASSIGNMENT_LHS	REMOVED	arguments	2
403	RESERVED	ASSIGNMENT_LHS	REMOVED	import	2
404	RESERVED	ASSIGNMENT_LHS	REMOVED	null	2
405	RESERVED	ASSIGNMENT_LHS	REMOVED	yield	2
406	CONVENTION	ASSIGNMENT_LHS	UPDATED	error	2
407	RESERVED	ASSIGNMENT_RHS	INSERTED	typeof	2
408	CONVENTION	ASSIGNMENT_RHS	REMOVED	callback	2
409	RESERVED	ASSIGNMENT_RHS	REMOVED	default	2
410	CONVENTION	ASSIGNMENT_RHS	UPDATED	error	2
411	RESERVED	CONDITION	INSERTED	else	2
412	RESERVED	CONDITION	INSERTED	private	2
413	RESERVED	CONDITION	REMOVED	long	2
414	RESERVED	CONDITION	REMOVED	package	2
415	RESERVED	CONDITION	UPDATED	arguments	2
416	CONVENTION	CONDITION	UPDATED	error	2
417	RESERVED	EXPRESSION	INSERTED	typeof	2
418	RESERVED	EXPRESSION	REMOVED	package	2
419	RESERVED	METHOD_CALL	INSERTED	default	2
420	RESERVED	METHOD_CALL	INSERTED	delete	2
421	RESERVED	METHOD_CALL	INSERTED	finally	2
422	RESERVED	METHOD_CALL	INSERTED	true	2
423	RESERVED	METHOD_CALL	REMOVED	new	2
424	RESERVED	METHOD_CALL	UPDATED	boolean	2
425	RESERVED	METHOD_CALL	UPDATED	catch	2
426	RESERVED	METHOD_DECLARATION	REMOVED	static	2
427	RESERVED	PARAMETER_DECLARATION	REMOVED	undefined	2
428	RESERVED	VARIABLE_DECLARATION	INSERTED	package	2
429	CLASS	ARGUMENT	INSERTED	Date	1
430	CLASS	ARGUMENT	REMOVED	Object	1
431	CLASS	ARGUMENT	REMOVED	String	1
432	CLASS	ARGUMENT	UPDATED	RegExp	1
433	CLASS	METHOD_CALL	INSERTED	Number	1
434	CLASS	METHOD_CALL	REMOVED	Number	1
435	CLASS	METHOD_CALL	UPDATED	Math	1
436	FIELD	ARGUMENT	REMOVED	1	
437	FIELD	ASSIGNMENT_LHS	UPDATED	1	
438	FIELD	ASSIGNMENT_LHS	UPDATED	name	1
439	FIELD	ASSIGNMENT_RHS	REMOVED	source	1
440	FIELD	ASSIGNMENT_RHS	UPDATED	1	

441	FIELD	ASSIGNMENT_RHS	UPDATED	name	1
442	FIELD	ASSIGNMENT_RHS	UPDATED	prototype	1
443	FIELD	CONDITION	REMOVED	ignoreCase	1
444	FIELD	CONDITION	REMOVED	multiline	1
445	FIELD	CONDITION	UPDATED	message	1
446	FIELD	CONDITION	UPDATED	source	1
447	FIELD	EXPRESSION	REMOVED	source	1
448	FIELD	METHOD_CALL	INSERTED	source	1
449	FIELD	METHOD_CALL	REMOVED	length	1
450	FIELD	METHOD_CALL	REMOVED	name	1
451	FIELD	METHOD_CALL	UPDATED	constructor	1
452	FIELD	METHOD_CALL	UPDATED	name	1
453	METHOD	ARGUMENT	INSERTED	bind	1
454	METHOD	ARGUMENT	INSERTED	hasOwnProperty	1
455	METHOD	ARGUMENT	INSERTED	map	1
456	METHOD	ARGUMENT	INSERTED	max	1
457	METHOD	ARGUMENT	INSERTED	min	1
458	METHOD	ARGUMENT	INSERTED	unescape	1
459	METHOD	ARGUMENT	REMOVED	bind	1
460	METHOD	ARGUMENT	REMOVED	exec	1
461	METHOD	ARGUMENT	REMOVED	search	1
462	METHOD	METHOD_CALL	INSERTED	decodeURI	1
463	METHOD	METHOD_CALL	INSERTED	getDate	1
464	METHOD	METHOD_CALL	INSERTED	getFullYear	1
465	METHOD	METHOD_CALL	INSERTED	getHours	1
466	METHOD	METHOD_CALL	INSERTED	getMilliseconds	1
467	METHOD	METHOD_CALL	INSERTED	getMonth	1
468	METHOD	METHOD_CALL	INSERTED	getPrototypeOf	1
469	METHOD	METHOD_CALL	INSERTED	getUTCDate	1
470	METHOD	METHOD_CALL	INSERTED	getUTCDay	1
471	METHOD	METHOD_CALL	INSERTED	getUTCHours	1
472	METHOD	METHOD_CALL	INSERTED	getUTCMonth	1
473	METHOD	METHOD_CALL	INSERTED	getUTCSeconds	1
474	METHOD	METHOD_CALL	INSERTED	propertyIsEnumerable	1
475	METHOD	METHOD_CALL	INSERTED	reduceRight	1
476	METHOD	METHOD_CALL	INSERTED	search	1
477	METHOD	METHOD_CALL	INSERTED	setHours	1
478	METHOD	METHOD_CALL	INSERTED	setSeconds	1
479	METHOD	METHOD_CALL	INSERTED	setTime	1
480	METHOD	METHOD_CALL	INSERTED	setUTCMinutes	1
481	METHOD	METHOD_CALL	REMOVED	encodeURI	1
482	METHOD	METHOD_CALL	REMOVED	getDay	1
483	METHOD	METHOD_CALL	REMOVED	getHours	1
484	METHOD	METHOD_CALL	REMOVED	getMinutes	1
485	METHOD	METHOD_CALL	REMOVED	getMonth	1
486	METHOD	METHOD_CALL	REMOVED	getSeconds	1
487	METHOD	METHOD_CALL	REMOVED	getTimezoneOffset	1
488	METHOD	METHOD_CALL	REMOVED	search	1
489	METHOD	METHOD_CALL	REMOVED	setHours	1
490	METHOD	METHOD_CALL	REMOVED	setMilliseconds	1
491	METHOD	METHOD_CALL	REMOVED	setMinutes	1
492	METHOD	METHOD_CALL	REMOVED	setSeconds	1
493	METHOD	METHOD_CALL	REMOVED	setTime	1
494	METHOD	METHOD_CALL	REMOVED	sqrt	1

495	METHOD	METHOD_CALL	REMOVED	toLocaleDateString	1
496	METHOD	METHOD_CALL	REMOVED	toLocaleString	1
497	METHOD	METHOD_CALL	REMOVED	unescape	1
498	METHOD	METHOD_CALL	UPDATED	String	1
499	METHOD	METHOD_CALL	UPDATED	defineProperty	1
500	METHOD	METHOD_CALL	UPDATED	getTime	1
501	METHOD	METHOD_CALL	UPDATED	is	1
502	METHOD	METHOD_CALL	UPDATED	isNaN	1
503	METHOD	METHOD_CALL	UPDATED	parseInt	1
504	METHOD	METHOD_CALL	UPDATED	random	1
505	METHOD	METHOD_CALL	UPDATED	reduce	1
506	METHOD	METHOD_CALL	UPDATED	setHours	1
507	METHOD	METHOD_CALL	UPDATED	some	1
508	METHOD	METHOD_CALL	UPDATED	substr	1
509	METHOD	METHOD_CALL	UPDATED	substring	1
510	METHOD	METHOD_CALL	UPDATED	toJSON	1
511	METHOD	METHOD_CALL	UPDATED	valueOf	1
512	METHOD	METHOD_DECLARATION	INSERTED	parse	1
513	METHOD	METHOD_DECLARATION	REMOVED	reverse	1
514	RESERVED	ARGUMENT	INSERTED	class	1
515	RESERVED	ARGUMENT	INSERTED	volatile	1
516	RESERVED	ARGUMENT	REMOVED	import	1
517	RESERVED	ARGUMENT	REMOVED	in	1
518	CONVENTION	ARGUMENT	UPDATED	callback	1
519	RESERVED	ASSIGNMENT_LHS	INSERTED	export	1
520	RESERVED	ASSIGNMENT_LHS	INSERTED	extends	1
521	RESERVED	ASSIGNMENT_LHS	INSERTED	interface	1
522	RESERVED	ASSIGNMENT_LHS	INSERTED	let	1
523	RESERVED	ASSIGNMENT_LHS	INSERTED	new	1
524	RESERVED	ASSIGNMENT_LHS	INSERTED	public	1
525	RESERVED	ASSIGNMENT_LHS	INSERTED	static	1
526	RESERVED	ASSIGNMENT_LHS	INSERTED	typeof	1
527	RESERVED	ASSIGNMENT_LHS	REMOVED	boolean	1
528	RESERVED	ASSIGNMENT_LHS	REMOVED	char	1
529	RESERVED	ASSIGNMENT_LHS	REMOVED	class	1
530	RESERVED	ASSIGNMENT_LHS	REMOVED	delete	1
531	RESERVED	ASSIGNMENT_LHS	REMOVED	in	1
532	RESERVED	ASSIGNMENT_LHS	REMOVED	let	1
533	RESERVED	ASSIGNMENT_LHS	REMOVED	long	1
534	RESERVED	ASSIGNMENT_LHS	REMOVED	native	1
535	RESERVED	ASSIGNMENT_LHS	REMOVED	short	1
536	RESERVED	ASSIGNMENT_LHS	REMOVED	throws	1
537	RESERVED	ASSIGNMENT_LHS	REMOVED	undefined	1
538	RESERVED	ASSIGNMENT_LHS	REMOVED	with	1
539	RESERVED	ASSIGNMENT_LHS	UPDATED	delete	1
540	RESERVED	ASSIGNMENT_RHS	INSERTED	char	1
541	RESERVED	ASSIGNMENT_RHS	INSERTED	delete	1
542	RESERVED	ASSIGNMENT_RHS	INSERTED	interface	1
543	RESERVED	ASSIGNMENT_RHS	REMOVED	arguments	1
544	RESERVED	ASSIGNMENT_RHS	REMOVED	char	1
545	RESERVED	ASSIGNMENT_RHS	REMOVED	import	1
546	RESERVED	CONDITION	INSERTED	long	1
547	RESERVED	CONDITION	INSERTED	return	1
548	RESERVED	CONDITION	INSERTED	throws	1

549	RESERVED	CONDITION	INSERTED	volatile	1
550	RESERVED	CONDITION	REMOVED	default	1
551	RESERVED	CONDITION	REMOVED	throws	1
552	CONVENTION	EXPRESSION	INSERTED	callback	1
553	RESERVED	EXPRESSION	INSERTED	default	1
554	RESERVED	EXPRESSION	INSERTED	false	1
555	RESERVED	EXPRESSION	INSERTED	long	1
556	RESERVED	EXPRESSION	INSERTED	new	1
557	RESERVED	EXPRESSION	REMOVED	arguments	1
558	RESERVED	EXPRESSION	REMOVED	long	1
559	RESERVED	EXPRESSION	UPDATED	arguments	1
560	RESERVED	METHOD_CALL	INSERTED	arguments	1
561	RESERVED	METHOD_CALL	INSERTED	false	1
562	RESERVED	METHOD_CALL	INSERTED	interface	1
563	RESERVED	METHOD_CALL	INSERTED	new	1
564	RESERVED	METHOD_CALL	INSERTED	null	1
565	RESERVED	METHOD_CALL	INSERTED	public	1
566	RESERVED	METHOD_CALL	INSERTED	with	1
567	RESERVED	METHOD_CALL	REMOVED	default	1
568	RESERVED	METHOD_CALL	REMOVED	export	1
569	RESERVED	METHOD_CALL	REMOVED	throws	1
570	RESERVED	METHOD_CALL	REMOVED	true	1
571	CONVENTION	METHOD_CALL	UPDATED	callback	1
572	RESERVED	METHOD_CALL	UPDATED	default	1
573	RESERVED	METHOD_CALL	UPDATED	export	1
574	RESERVED	METHOD_CALL	UPDATED	finally	1
575	RESERVED	METHOD_CALL	UPDATED	in	1
576	RESERVED	METHOD_CALL	UPDATED	throws	1
577	CONVENTION	METHOD_DECLARATION	INSERTED	error	1
578	RESERVED	PARAMETER_DECLARATION	INSERTED	volatile	1
579	CONVENTION	PARAMETER_DECLARATION	UPDATED	error	1
580	RESERVED	VARIABLE_DECLARATION	INSERTED	private	1
581	RESERVED	VARIABLE_DECLARATION	INSERTED	static	1
582	RESERVED	VARIABLE_DECLARATION	INSERTED	volatile	1