safety

MDPI

Data Descriptor

A Model to Predict Children's Reaction Time at Signalized Intersections

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Abstract: Traffic accident statistics in urban areas, both locally in Croatia and at the European level, identify children as a group of vulnerable road users. The analysis of the parameters that influence the interaction of child pedestrians and other road users requires special attention. This paper presents the results of research about the reaction time of children, measured both in laboratory conditions, via a computer reaction time test, and in actual traffic conditions. The results of the reaction time in the situation of expected stimuli (computer test) of children aged 6 to 10 years were compared with the results of the reaction time of adult traffic participants, drivers, who also took part in the computer test. In actual traffic conditions, the reaction time of children aged 4 to 16 years at the signalized intersection was measured. The model for predicting the reaction time of children in real traffic conditions was created using a neural network. Parameters influencing children's reaction time in real traffic conditions have been identified by applying both statistical analysis and the developed neural network model. The case study was conducted at selected signalized intersections in the city of Osijek, Croatia.

Keywords: children in traffic; signalized intersections; reaction time; prediction model; neural networks

1. Summary

In this research the reaction time of children was measured under controlled conditions using computer software and in actual traffic conditions at a signalized intersection. The aim of this research is to increase the safety of specific segments of urban traffic network in close vicinity of schools and kindergartens. The case study was made for a selected intersection with traffic lights in the city of Osijek.

The methodology followed to develop the whole research is based on two steps: first of all, a laboratory experiment was carried out with a computer test, where both a target (children) and a control (adult) group had to react to an external displayed stimulus; the second step is the measure the reaction time of the same participants in real traffic conditions.

The first step allowed to identify some parameters influencing the reaction time under controlled conditions, and put the basis for the analysis and selection of the most influential parameters to be set as inputs for the neural network model.

Data collection under laboratory conditions was made within the framework of the project of the Croatian Science Foundation Problems in the Behavior of School-aged Children: The Role of Executive Functions, Individual, Family and Genetic Factors-ECLAT, project leader Asoc.prof. Silvije Ručević, HRZZ-IP-2016-06-3917. This research did not engage other project resources except for the availability of the target group for the research.

In the working phase of data collection, an article with descriptive statistics was published:

Ištoka Otković, Irena; Ručević, Silvija; Borovac, Tijana; Marschhauser, Max; Jeremić, Kristina. Analysis of the results of traffic participants' time of reaction research for prevention of

traffic insecurity // 6th International Scientific Symposium Economy of Eastern Croatia – Vision and Growth / Mašek Tonković, Anka (ur.). Osijek: Studio HS internet d.o.o., Osijek, 2017. pp.826–835 http://www.efos.unios.hr/red/en/proceedings/

The final database expanded by 20% of reaction time measurements was used in this article as well as statistical analyzes not made in the research work phase.

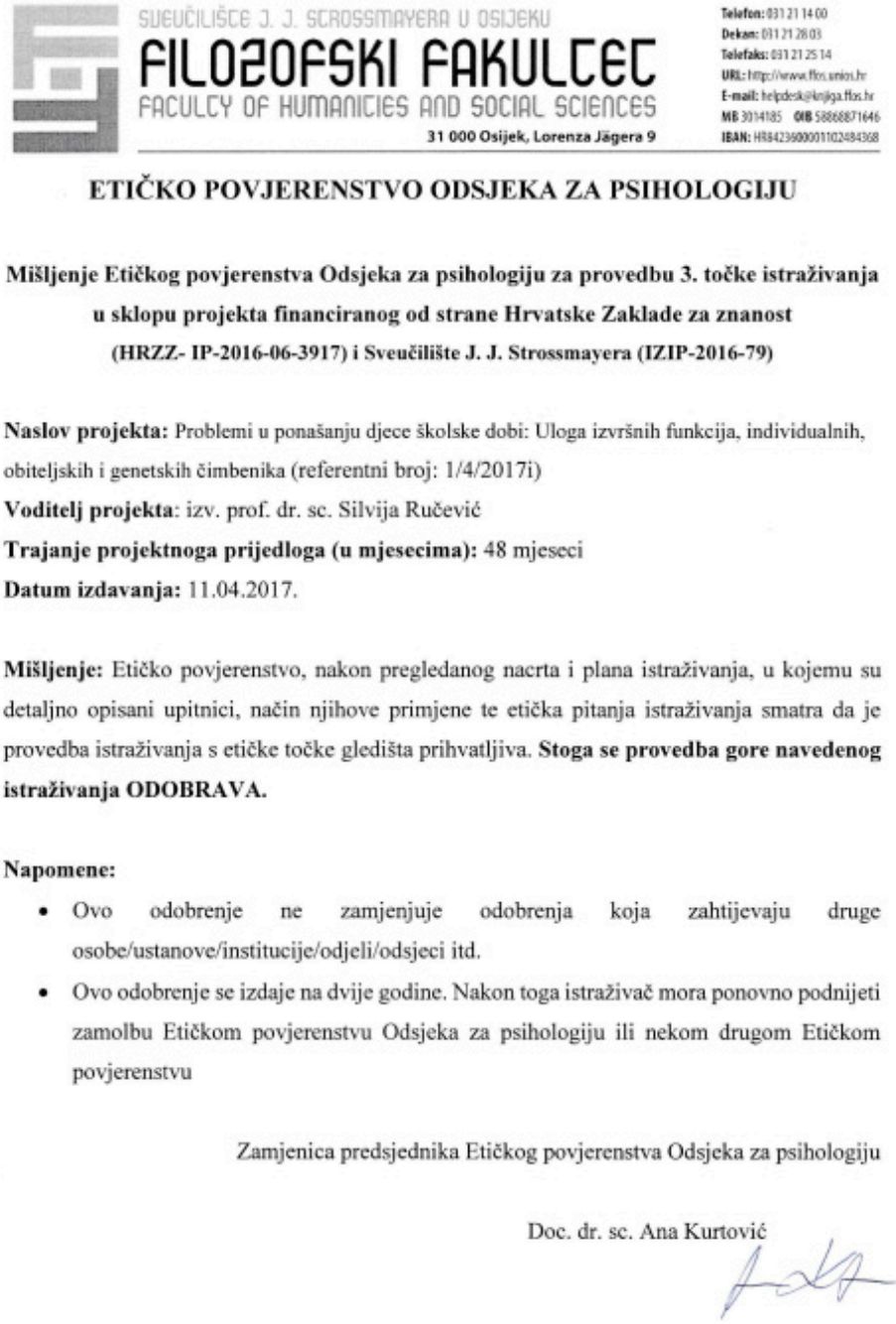
2. Methods

The methodology followed to develop the whole research is based on two steps: first of all, a laboratory experiment was carried out with a computer test, where both a target (children) and a control (adult) group had to react to an external displayed stimulus; the second step is the measure the reaction time of the same participants in real traffic conditions.

The target group consists of kindergarten and elementary school children, and the control group consists of drivers from the city of Osijek. The database contains measurement results of 448 target group respondents (four groups of 112 measurements each) and 112 control group examinees. The reaction time was measured in controlled conditions, using Human benchmark Reaction time test (http://www.humanbenchmark.com/tests/reactiontime) (computer on-line test) on all participants, and additional data were gathered through a survey filled in both by the target and the control group.

The target group was divided into four subgroups—preschoolers (children from 6 to 7 years old), first class (children from 7 to 8 years old), second class (children from 8 to 9 years old) and third class (children from 9 to 10 years old) children. In this phase of the research, the working hypothesis was that the reaction times of each target group was longer than the reaction times of the control group, even in the conditions of expected stimuli. To each respondent it was explained what would be measured, how they should respond (press the mouse button when a red color appears on the screen), and each of them had the opportunity to try the test first, without recording the results. The reaction time was measured in milliseconds and the mean reaction time of 5 consecutive measurements for each respondent was registered.

Regarding ethical questions of research involving children, individual permissions for interviewing and measuring different indicators of executive behavior of each child were sign by the parents and only those children whose parents signed the consent were examined. Figure 1 is the approval of the Ethics Committee of the Josip Juraj Strossmayer University of Osijek, Faculty of Humanities and Social Sciences, to collect data and measure different indicators of children's executive behavior (reference number: 1/4/2017i).



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ETIČKO POVJERENSTVO ODSJEKA ZA PSIHOLOGIJU

Mišljenje Etičkog povjerenstva Odsjeka za psihologiju za provedbu 3. točke istraživanja u sklopu projekta financiranog od strane Hrvatske Zaklade za znanost (HRZZ- IP-2016-06-3917) i Sveučilište J. J. Strossmayera (IZIP-2016-79)

Naslov projekta: Problemi u ponašanju djece školske dobi: Uloga izvršnih funkcija, individualnih, obiteljskih i genetskih čimbenika (referentni broj: 1/4/2017i)
Voditelj projekta: izv. prof. dr. sc. Silvija Ručević
Trajanje projektnoga prijedloga (u mjesecima): 48 mjeseci
Datum izdavanja: 11.04.2017.

Mišljenje: Etičko povjerenstvo, nakon pregledanog nacrta i plana istraživanja, u kojemu su detaljno opisani upitnici, način njihove primjene te etička pitanja istraživanja smatra da je provedba istraživanja s etičke točke gledišta prihvatljiva. **Stoga se provedba gore navedenog istraživanja ODOBRAVA.**

Napomene:

- Ovo odobrenje ne zamjenjuje odobrenja koja zahtijevaju druge osobe/ustanove/institucije/odjeli/odsjeci itd.
- Ovo odobrenje se izdaje na dvije godine. Nakon toga istraživač mora ponovno podnijeti zamolbu Etičkom povjerenstvu Odsjeka za psihologiju ili nekom drugom Etičkom povjerenstvu

Zamjenica predsjednika Etičkog povjerenstva Odsjeka za psihologiju

Doc. dr. sc. Ana Kurtović

Figure 1. Approval of the Ethics Committee.

The primary objective of the second phase of research, the in-situ research, was to collect data about the behavior and reaction time of children in actual traffic conditions, when children are influenced by the usual distractors in a familiar environment. A database of measured reaction time of children aged 5 to 16 years at a selected signalized intersection set on urban arterial road was created. The observed intersection is located near two primary schools and kindergarten. The

signalized intersection is traditionally considered as a pedestrian-friendly traffic solution because it does not require a detailed assessment of the traffic situation and was selected for the first phase of the study of traffic behavior of children. No license was required for video recording of traffic without personally identifying traffic users.

3. Data Description

3.1. Database1

A database of measurement results of the reaction time of the target group (child pedestrians) and a control group (adult drivers) under controlled conditions was created.

Table 1 shows the reaction time measured by a computer test, as described in the previous section.

Table 1. A database of measurement results of the reaction time.

Control Group	Preschoolers	First Class	Second Class	Third Class
240	352	298	250	244
244	376	299	256	248
250	390	302	264	252
250	410	305	276	260
251	415	312	280	268
252	420	318	296	270
253	425	326	300	282
254	430	334	304	288
255	440	350	309	292
256	452	355	312	294
258	460	358	318	296
260	482	360	320	298
262	490	362	320	300
263	496	375	321	300
264	502	382	324	304
264	506	390	325	306
265	510	401	328	308
266	512	405	331	310
266	517	406	332	312
267	519	407	333	314
270	520	408	335	315
272	525	410	336	316
273	530	412	340	318
275	533	415	342	320
277	535	416	344	322
279	542	418	346	325
279	550	420	347	328
281	551	422	348	330
283	553	424	370	334
284	556	425	372	336

285	561	427	374	340
285	562	432	375	346
286	563	438	376	349
286	565	442	377	350
287	568	443	380	352
288	570	444	381	353
289	576	445	382	354
290	584	450	383	356
291	592	452	384	360
292	598	454	385	365
292	602	455	388	368
294	604	458	389	370
295	606	459	390	372
295	608	460	395	374
296	609	462	398	375
296	609	463	400	376
297	610	464	402	377
297	610	465	402	378
297	610	466	403	380
299	610	467	404	380
299	611	468	405	380
300	612	468	405	382
300	612	469	406	382
303	613	470	406	383
304	614	470	407	384
305	615	471	408	384
305	616	472	408	385
306	616	473	409	386
306	618	474	409	386
307	620	476	410	387
308	620	480	410	388
310	620	482	410	388
312	621	491	412	389
313	622	494	412	389
314	624	498	414	390
314	629	502	415	390
315	633	504	420	392
316	641	506	425	394
316	645	508	428	395
316	650	510	430	396
318	652	510	440	401
319	654	512	442	405
319	660	512	445	406

320	662	515	446	408
320	665	518	448	410
320	670	518	450	412
321	671	520	452	418
322	680	522	454	419
322	683	525	456	420
323	687	530	458	425
324	690	538	460	426
324	690	546	462	428
325	698	548	464	430
326	699	550	468	432
327	702	552	470	436
329	706	554	476	438
331	708	560	480	440
332	710	562	482	442
333	712	563	496	444
336	715	566	498	445
338	718	568	502	446
340	720	570	505	448
341	724	573	508	452
342	746	576	510	455
344	755	578	512	460
345	760	580	514	464
346	762	588	518	478
350	770	590	520	486
355	786	592	524	492
358	790	596	526	498
359	798	604	528	500
361	810	609	532	502
361	830	631	536	506
365	842	642	540	510
366	846	654	554	512
370	852	660	566	518
375	864	678	573	520
376	872	706	589	526
380	886	720	599	532
382	910	732	600	538
385	922	762	630	544
388	930	812	646	552

3.2. Database2

Based on previous experience and technical judgement of the situation, seven independent variables affecting the reaction time of children in traffic were selected:

- age group

- gender
- children with special needs (motoric disabilities, low vision and blindness, wheelchair mobility, etc.)
- movement in a group—the number of children in a group
- supervision by adults
- mobile–text- messages/internet
- mobile–talk, listening music

The age group input parameter was formed in such a way that each respondent with a measured reaction time was classified into one of the seven categories, as follows:

1→≤ 5 years old children; 2→6 to 7 years; 3→8 to 9 years; 4→10 to 11 years; 5→12 to 13 years; 6→14 to 15 years; 7→>15—over 15 years old).

Other parameters

- gender [girl →0, boys →1, for mixed groups (number of boys/total number of children)]
- children with special needs (motoric disabilities, low vision and blindness, wheelchair mobility, etc.) [no→0, minor interference→0,5, yes→1]
- movement in a group—the number of children in a group [number]—the whole group has the same crossing time and it is one data in a database, and the crossing time is the total transition time from the first to the last member of the group
- supervision by adults [no→0; yes→1]
- mobile–messages/internet—occupies visual attention [no→0; yes→1]
- mobile–talk, listening music—does not occupy visual attention [no→0; yes→1]
- dependent variable—reaction time measured in situ

Table 2 shows the database measured in actual traffic conditions.

Table 2. Database measured in actual traffic conditions.

Age	Gender	Dissbil.	moving independ/in a group	Supervis.	MOB TXT	MOB SPEAK	Time of Reaction
5	0	0	2	0	0	0	2
7	0	0	1	0	0	0	0.5
6	0	0	3	0	0	0	4
6	1	0	2	0	0	0	3
7	1	0	1	0	0	0	0.5
6	0	0	1	0	1	0	4
5	0	0	1	0	0	0	0.5
6	1	0	1	0	0	0	0.5
5	0.5	0	2	0	0	0	3.5
5	1	0	1	0	0	0	0.5
7	1	1	1	0	0	0	5
6	0	0	1	0	0	1	1.5
6	0	0	1	0	0	0	0.5
6	1	0	1	0	0	0	1
5	1	0	1	0	0	0	1
6	1	0	1	0	0	0	1
5	1	0	1	0	0	0	0.5
5	0	0	1	0	0	0	0.5
5	1	0	1	0	0	0	1
5	0	0	1	0	0	0	0.5
5	1	0	2	0	0	0	2

6	0	0	1	0	0	0	1
6	1	0	1	0	0	0	1
5	0	0	1	0	0	0	0.5
5	0	0	1	0	0	0	0.5
5	1	0	1	0	0	0	0.5
4	0	0	2	0	0	0	3.5
3	0	0	1	0	0	0	1
4	1	0	1	0	0	0	1
4	1	0	3	0	0	0	4
4	0.33	0	3	0	0	0	3
4	1	0	1	0	0	0	1
4	1	0	2	0	0	0	3
3	0	0	1	0	0	0	1
5	0	0	1	0	0	0	0.5
3	0	0	1	0	0	0	1
6	0	0	1	0	0	0	1
4	1	0	1	0	0	0	1
4	0	0	1	0	0	0	1
3	0	0	2	0	0	0	3
3	1	0	1	0	0	0	1
3	1	0	1	0	0	0	1
2	0	0	1	1	0	0	1.5
5	0	0	2	0	0	0	2
3	1	0	2	0	0	0	2.5
6	1	0	1	0	0	0	1
5	1	0	1	0	1	0	4
4	0	0	2	0	0	0	2.5
4	1	0	2	0	0	0	3
5	0	0	1	0	0	1	3
4	1	0	1	0	0	0	1
5	0	0	1	0	0	1	2
5	1	0	1	0	0	0	1
6	1	0	1	0	0	0	0.5
3	1	1	1	1	0	0	6
5	0	0	1	0	0	0	0.5
5	0	0	0	0	0	0	0.5
6	0	0	1	0	0	1	2.5
4	0	0	0	0	0	0	1
7	1	0	2	0	0	0	2.5
3	1	0	1	0	0	0	1.5
6	1	0	1	0	0	0	0.5
7	0.5	0	2	0	0	0	2.5
3	0	0	2	0	0	0	3

3	0	0	1	0	0	0	1
4	0	0	1	0	0	1	2
3	1	0	1	0	0	0	1
7	0	0	1	0	1	0	4.5
2	0	0	1	1	0	0	1.5
5	1	0	1	0	0	0	1
5	0	0	1	0	0	0	0.5
6	0	0	1	0	0	0	0.5
5	1	0	3	0	0	0	3
6	0	0	1	0	0	1	1.5
5	0	0	1	0	0	0	0.5
6	1	0	1	0	0	0	0.5
7	1	0	2	0	0	0	2
7	0	0	1	0	0	0	0.5
6	0	0	2	0	0	0	2
6	0	0	1	0	0	1	2
5	0	0	1	0	0	0	0.5
7	0	0	1	0	0	0	0.5
6	0	0	2	0	0	0	2
6	0	0	1	0	0	0	0.5
7	1	0	1	0	0	0	1
5	1	0	1	0	0	0	1
5	0	0	1	0	0	0	0.5
5	0	0	1	0	0	0	1
5	1	0	1	0	0	0	1
6	1	0	1	0	0	1	1.5
6	0	0	2	0	0	0	2
2	0	0	1	0	0	0	2
6	1	0	1	0	0	0	1
5	0	0	4	0	0	0	3.5
5	1	0	2	0	0	0	3
6	0	0	2	0	0	0	2
6	0	0	1	0	0	0	0.5
6	0	0	3	0	0	0	2.5
5	1	0	1	0	0	0	0.5
5	0	0	1	0	0	0	0.5
5	1	0	5	0	0	0	4.5
4	0	0	1	0	0	0	0.5
4	1	0	2	0	0	0	2
6	0	0	1	0	0	0	0.5
5	1	0	4	0	0	0	3.5
2	1	0	1	0	0	0	3
4	0	0	1	0	0	0	0.5

1	1	0	1	1	0	0	2
6	0	0	1	0	0	1	2
6	0	0	2	0	1	0	5.5
7	1	0	1	0	0	0	1
7	1	0	1	0	0	0	0.5
6	0	0	1	0	0	0	0.5
7	0	0	2	0	0	0	2
6	0	0	1	0	0	1	2.5
6	0	0	1	0	1	0	5
7	1	0	1	0	0	0	1
6	1	0	1	0	0	0	1
3	1	0	2	0	0	0	3.5
5	1	0	1	0	0	0	1
7	1	0	1	0	0	0	0.5
5	0.33	0	3	0	0	0	3
6	1	0	1	0	0	0	0.5
4	1	0	1	0	0	0	1
6	1	0	1	0	0	0	0.5
6	0	0	1	0	0	0	0.5
3	1	0	1	0	0	0	1
7	0	0	1	0	0	0	0.5
2	0	0	1	0	0	0	1.5
7	0	0	1	0	0	0	0.5
3	1	0	3	0	0	0	4.5
3	1	0	1	0	0	0	1
7	1	0	3	0	0	0	2.5
7	1	0	1	0	0	0	0.5
6	0	0	1	0	0	0	0.5
6	0	0	1	0	1	0	6
2	1	0	1	0	0	0	1.5
6	0	0	2	0	1	0	6.5
7	0	0	1	0	0	0	0.5
4	1	0	1	0	0	0	1
7	1	0	1	0	0	0	0.5
6	0	0	1	0	0	0	1
6	1	0	1	0	0	0	0.5
5	1	0	1	0	0	0	1
5	1	0	1	0	0	0	0.5
6	1	0	1	0	0	1	1.5
4	0.5	0	6	0	0	0	5
4	0	0	2	0	0	0	3
2	1	0	1	0	0	0	2.5
4	0.5	0	4	0	0	0	4

6	1	0	1	0	1	0	5
7	0	0	1	0	0	1	2
5	0.5	0	4	0	0	0	3.5
6	0	0	2	0	1	0	8
6	1	0	2	0	0	0	3
7	0	0	1	0	0	0	0.5
5	1	0	1	0	0	0	1
2	1	0	1	1	0	0	1.5
7	1	0	1	0	0	0	0.5
5	1	0	1	0	0	0	1
6	1	0	1	0	0	0	0.5
6	0	0	1	0	0	0	0.5
3	1	0	1	0	0	0	1.5
3	0	0	1	0	0	0	1
2	0	0	1	0	0	0	2
6	0	0	1	0	0	0	0.5
5	1	0	1	0	0	0	1
7	1	0	1	0	0	0	0.5
5	0	0	1	0	0	0	0.5
6	1	0	1	0	0	0	1
1	1	0	1	1	0	0	2
5	0	0	1	0	0	0	0.5
4	0	0	2	0	0	0	2
5	0	0	3	0	0	0	2.5
6	0	0	1	0	1	0	5
7	1	0	1	0	0	1	2.5
3	1	0	1	0	0	0	1.5
6	0	0	1	0	0	1	2
6	0	0	1	0	0	0	0.5
6	0.66	0	3	0	0	0	3.5
3	0	0	1	0	0	0	1.5
3	1	0	1	0	0	0	2
6	0.5	0	2	0	0	0	3
1	0	0	1	0	0	0	0.5
6	0	0	1	0	0	1	2.5
3	0	0	1	0	0	0	1
3	1	0	1	0	0	0	1.5
2	0	0	1	0	0	0	2
2	1	0	1	0	0	0	2.5
4	1	0	2	0	0	0	3
6	0	0	1	0	0	1	1.5
6	0	0	1	0	0	0	1

The database of 192 measured reaction times in actual traffic conditions was used to define and train the neural network.

3.2.1. Result of Neural Network Predictions

Table 3 shows the results of neural network prediction

Table 3. Result of Neural Network Predictions.

	Actual (1)	Network (1)	Act-Net (1)
1	2	1.912821174	0.087178826
2	0.5	0.555350661	−0.055350661
3	4	3.066304684	0.933695316
4	3	1.977504253	1.022495747
5	0.5	0.721236289	−0.221236289
6	4	4.779056549	−0.779056549
7	0.5	0.788813651	−0.288813651
8	0.5	0.847270966	−0.347270966
9	3.5	2.058722734	1.441277266
10	0.5	1.012782931	−0.512782931
11	5	4.90843153	0.09156847
12	1.5	1.963680625	−0.463680625
13	0.5	0.655910194	−0.155910194
14	1	0.847270966	0.152729034
15	1	1.012782931	−0.012782931
16	1	0.847270966	0.152729034
17	0.5	1.012782931	−0.512782931
18	0.5	0.788813651	−0.288813651
19	1	1.012782931	−0.012782931
20	0.5	0.788813651	−0.288813651
21	2	2.194428921	−0.194428921
22	1	0.655910194	0.344089806
23	1	0.847270966	0.152729034
24	0.5	0.788813651	−0.288813651
25	0.5	0.788813651	−0.288813651
26	0.5	1.012782931	−0.512782931
27	3.5	2.127940416	1.372059584
28	1	1.170168281	−0.170168281
29	1	1.223336697	−0.223336697
30	4	3.584757566	0.415242434
31	3	3.433954	−0.433954
32	1	1.223336697	−0.223336697
33	3	2.452126265	0.547873735
34	1	1.170168281	−0.170168281
35	0.5	0.788813651	−0.288813651
36	1	1.170168281	−0.170168281
37	1	0.655910194	0.344089806
38	1	1.223336697	−0.223336697
39	1	0.958806157	0.041193843
40	3	2.376458406	0.623541594
41	1	1.483470917	−0.483470917
42	1	1.483470917	−0.483470917

43	1.5	1.242611766	0.257388234
44	2	1.912821174	0.087178826
45	2.5	2.748173475	−0.248173475
46	1	0.847270966	0.152729034
47	4	5.126285553	−1.126285553
48	2.5	2.127940416	0.372059584
49	3	2.452126265	0.547873735
50	3	2.187721729	0.812278271
51	1	1.223336697	−0.223336697
52	2	2.187721729	−0.187721729
53	1	1.012782931	−0.012782931
54	0.5	0.847270966	−0.347270966
55	6	5.796794891	0.203205109
56	0.5	0.788813651	−0.288813651
57	0.5	0.788813651	−0.288813651
58	2.5	1.963680625	0.536319375
59	1	0.958806157	0.041193843
60	2.5	1.801196694	0.698803306
61	1.5	1.483470917	0.016529083
62	0.5	0.847270966	−0.347270966
63	2.5	1.689571142	0.810428858
64	3	2.376458406	0.623541594
65	1	1.170168281	−0.170168281
66	2	2.429891348	−0.429891348
67	1	1.483470917	−0.483470917
68	4.5	4.56542635	−0.06542635
69	1.5	1.242611766	0.257388234
70	1	1.012782931	−0.012782931
71	0.5	0.788813651	−0.288813651
72	0.5	0.655910194	−0.155910194
73	3	3.397898197	−0.397898197
74	1.5	1.963680625	−0.463680625
75	0.5	0.788813651	−0.288813651
76	0.5	0.847270966	−0.347270966
77	2	1.801196694	0.198803306
78	0.5	0.555350661	−0.055350661
79	2	1.731890082	0.268109918
80	2	1.963680625	0.036319375
81	0.5	0.788813651	−0.288813651
82	0.5	0.555350661	−0.055350661
83	2	1.731890082	0.268109918
84	0.5	0.655910194	−0.155910194
85	1	0.721236289	0.278763711
86	1	1.012782931	−0.012782931
87	0.5	0.788813651	−0.288813651
88	1	0.788813651	0.211186349
89	1	1.012782931	−0.012782931

90	1.5	1.679797769	−0.179797769
91	2	1.731890082	0.268109918
92	2	1.425770879	0.574229121
93	1	0.847270966	0.152729034
94	3.5	4.061533928	−0.561533928
95	3	2.194428921	0.805571079
96	2	1.731890082	0.268109918
97	0.5	0.655910194	−0.155910194
98	2.5	3.066304684	−0.566304684
99	0.5	1.012782931	−0.512782931
100	0.5	0.788813651	−0.288813651
101	4.5	4.547066689	−0.047066689
102	0.5	0.958806157	−0.458806157
103	2	2.452126265	−0.452126265
104	0.5	0.655910194	−0.155910194
105	3.5	4.175287247	−0.675287247
106	3	1.795311809	1.204688191
107	0.5	0.958806157	−0.458806157
108	2	2.040986061	−0.040986061
109	2	1.963680625	0.036319375
110	5.5	6.566308975	−1.066308975
111	1	0.721236289	0.278763711
112	0.5	0.721236289	−0.221236289
113	0.5	0.655910194	−0.155910194
114	2	1.58428812	0.41571188
115	2.5	1.963680625	0.536319375
116	5	4.779056549	0.220943451
117	1	0.721236289	0.278763711
118	1	0.847270966	0.152729034
119	3.5	2.748173475	0.751826525
120	1	1.012782931	−0.012782931
121	0.5	0.721236289	−0.221236289
122	3	3.273521662	−0.273521662
123	0.5	0.847270966	−0.347270966
124	1	1.223336697	−0.223336697
125	0.5	0.847270966	−0.347270966
126	0.5	0.655910194	−0.155910194
127	1	1.483470917	−0.483470917
128	0.5	0.555350661	−0.055350661
129	1.5	1.425770879	0.074229121
130	0.5	0.555350661	−0.055350661
131	4.5	3.79486084	0.70513916
132	1	1.483470917	−0.483470917
133	2.5	3.105931282	−0.605931282
134	0.5	0.721236289	−0.221236289
135	0.5	0.655910194	−0.155910194
136	6	4.779056549	1.220943451

137	1.5	1.795311809	−0.295311809
138	6.5	6.566308975	−0.066308975
139	0.5	0.555350661	−0.055350661
140	1	1.223336697	−0.223336697
141	0.5	0.721236289	−0.221236289
142	1	0.655910194	0.344089806
143	0.5	0.847270966	−0.347270966
144	1	1.012782931	−0.012782931
145	0.5	1.012782931	−0.512782931
146	1.5	1.679797769	−0.179797769
147	5	4.672567844	0.327432156
148	3	2.127940416	0.872059584
149	2.5	1.795311809	0.704688191
150	4	4.201313972	−0.201313972
151	5	4.960109711	0.039890289
152	2	1.758889556	0.241110444
153	3.5	4.15208149	−0.65208149
154	8	6.566308975	1.433691025
155	3	1.977504253	1.022495747
156	0.5	0.555350661	−0.055350661
157	1	1.012782931	−0.012782931
158	1.5	1.673447132	−0.173447132
159	0.5	0.721236289	−0.221236289
160	1	1.012782931	−0.012782931
161	0.5	0.847270966	−0.347270966
162	0.5	0.655910194	−0.155910194
163	1.5	1.483470917	0.016529083
164	1	1.170168281	−0.170168281
165	2	1.425770879	0.574229121
166	0.5	0.655910194	−0.155910194
167	1	1.012782931	−0.012782931
168	0.5	0.721236289	−0.221236289
169	0.5	0.788813651	−0.288813651
170	1	0.847270966	0.152729034
171	2	2.040986061	−0.040986061
172	0.5	0.788813651	−0.288813651
173	2	2.127940416	−0.127940416
174	2.5	3.185944796	−0.685944796
175	5	4.779056549	0.220943451
176	2.5	1.503556252	0.996443748
177	1.5	1.483470917	0.016529083
178	2	1.963680625	0.036319375
179	0.5	0.655910194	−0.155910194
180	3.5	3.195608377	0.304391623
181	1.5	1.170168281	0.329831719
182	2	1.483470917	0.516529083
183	3	1.855218887	1.144781113

184	0.5	1.725953221	−1.225953221
185	2.5	1.963680625	0.536319375
186	1	1.170168281	−0.170168281
187	1.5	1.483470917	0.016529083
188	2	1.425770879	0.574229121
189	2.5	1.795311809	0.704688191
190	3	2.452126265	0.547873735
191	1.5	1.963680625	−0.463680625
192	1	0.655910194	0.344089806

3.2.2. Model validation

Independent validation of the model was made on a new database (which has not been previously presented to the NN, neither in the training set nor in the test set) consisting of 45 measured data (15 measurements at the first intersection, 30 measurements at a second location) of the reaction time of children at two different signalized intersections. Table 4 shows the results of model validation.

Table 4. Result of model validation.

Age	Gender	Dissbil.	moving independ/in a group	Supervis.	MOB TXT	MOB SPEAK	Time of Reaction	Predict
6	0	0	1	0	0	0	0.5	0.655910179
7	0	0	1	0	0	0	0.5	0.555350668
6	1	0	1	0	0	0	1	0.847270991
7	1	0	1	0	0	0	1	0.72123629
7	0	0	1	0	0	0	0.5	0.555350668
7	1	0	1	0	0	0	1	0.72123629
3	1	0	1	0	0	0	1.5	1.483470872
5	1	0	1	0	0	0	1	1.012782989
7	0	0	1	0	0	0	0.5	0.555350668
5	0	0	1	0	0	0	1	0.78881364
1	1	0	1	1	0	0	2	2.040986055
4	0	0	2	1	0	0	2	1.805259969
6	0	0	1	0	0	0	0.5	0.655910179
7	1	0	1	0	0	0	0.5	0.72123629
6	1	0	1	0	0	0	1	0.847270991
5	0	0	3	0	0	0	2.5	3.185944844
6	0	0	1	0	1	0	3.5	4.77905635
7	1	0	1	0	0	1	2.5	1.503556288
3	1	0	1	0	0	0	1.5	1.483470872
6	0	0	1	0	0	1	2	1.963680598
6	0	0	1	0	0	0	0.5	0.655910179
6	0.66	0	3	0	0	0	3	3.195608341
3	0	0	1	0	0	0	1.5	1.170168314
6	0	0	1	0	0	0	1	0.655910179
7	0	0	1	0	0	0	0.5	0.555350668
6	0.5	0	2	0	0	0	2.5	1.855218907

6	0	0	1	0	0	0	0.5	0.655910179
6	0	0	1	0	0	1	2.5	1.963680598
6	0	0	1	0	0	0	0.5	0.655910179
5	1	0	1	0	0	0	1	1.012782989
3	1	0	2	0	0	0	2	2.748173395
5	0	0	1	0	0	0	1	0.78881364
6	0	0	1	0	0	0	0.5	0.655910179
4	0.5	0	4	0	0	0	3.5	4.201313819
6	0	0	1	0	0	1	2	1.963680598
2	0	0	1	0	0	0	2	1.425770827
7	1	0	1	0	0	0	1	0.72123629
6	0.5	0	2	0	0	0	1.5	1.855218907
7	0	0	1	0	0	0	0.5	0.555350668
5	1	0	2	0	0	0	2	2.194428811
6	1	0	2	0	0	0	1.5	1.977504312
5	0	0	1	0	0	0	1	0.78881364
5	1	0	2	0	0	0	2	2.194428811
6	0	0	1	0	0	1	2	1.963680598
2	1	0	1	1	0	0	1.5	1.673447133

Appendix A

The appendix provides explanations for parents regarding the project objectives and examples of approvals given by parents for conducting research involving their children in the Croatian language.

PRIMJERI SUGLASNOSTI I DOPISA

Informacije o projektu »Problemi u ponašanju djece školske dobi: uloga izvršnih funkcija, individualnih, obiteljskih i genetskih čimbenika-ECLAT«

Dragi roditelji,
obraćamo Vam se molbom da Vi i Vaše dijete sudjelujete u 3. točki projekta o životu i funkcioniranju djece koji provodi Filozofski fakultet Osijek u suradnji s Fakultetom za odgojne i obrazovne znanosti. Istraživanje financiraju Hrvatska zaklada za znanost (HRZZ-IP-2016-06-3917), Sveučilište J. J. Strossmayera u Osijeku (IZIP-2016-81) i Filozofski fakultet Osijek.

1) Koji je cilj istraživanja?

Kako bismo bili uspješni u životu, potrebna nam je kreativnost, fleksibilnost, samokontrola i disciplina. Zajedničke svim tim osobinama jesu izvršne funkcije koje obuhvaćaju planiranje, fokusiranje i predviđanje ishoda ponašanja. Dosadašnja istraživanja pokazuju da u razvoju izvršnih funkcija djece važnu ulogu imaju roditelji, ali i učitelji. Cilj je istraživanja dobiti što bolji uvid u čimbenike koji mogu utjecati na funkcioniranje djece i njihovu dobrobit.

2) Što trebamo napraviti ako pristanemo sudjelovati?

Ako pristanete sudjelovati, Vi i Vaše dijete doći ćete, kao i prethodne godine, na Filozofski fakultet Osijek radi provedbe istraživanja. Termin Vašeg dolaska prilagodit ćemo Vašim obavezama. Vaše dijete rješavat će različite zadatke kojima se ispituje način njegova funkcioniranja. Zadaci se ispunjavaju na računalu. Rješavanje zadataka provodi se kroz igru. Vi ćete ispunjavati upitnike o ponašanju i funkcioniranju Vašeg djeteta te Vašim razmišljanjima i ponašanju u različitim odgojnim situacijama. Također ćete ispuniti i upitnike koji se odnose na Vaše svakodnevno funkcioniranje te različite zadatke na računalu (slične onima koje rješava i Vaše dijete). Tijekom rada Vi i Vaše dijete bit ćete u istoj prostoriji, tako da ćete u bilo kojem trenutku znati što Vaše dijete radi. Istraživanje traje do 90 minuta.

Također Vas molimo i za dopuštenje da učitelji ispune upitnike o funkcioniranju Vašeg djeteta u školi. Upitnici su jednaki onima koje ćete i Vi ispunjavati. Cilj nam je prikupiti što cjelovitiju sliku čimbenika povezanih sa svakodnevnim funkcioniranjem djece.

Kao i prethodnih godina, za sudjelovanje u istraživanju i utrošeno vrijeme primit ćete malu kompenzaciju. Vi ćete primiti paket s promotivnim materijalima, dok će Vaše dijete dobiti igračku/ školski pribor po Vašem izboru.

3) Što ako odbijemo sudjelovati?

Vaše je sudjelovanje u bilo kojem dijelu istraživanja dobrovoljno i možete ga u bilo kojem trenutku prekinuti bez ikakvih objašnjenja, no s obzirom na važnost ovog istraživanja nadamo se da to neće biti Vaš izbor.

4) Što je s povjerljivošću podataka?

Svi sudionici mogu odustati u bilo kojem trenutku, bez objašnjavanja svojih razloga za odustajanje. Sve su informacije navedene u upitnicima povjerljive i anonimne. To znači da Vaši odgovori nikomu neće biti otkriveni, osim ako je nečiji život u opasnosti ili ako Vi sami ne zatražite razgovor sa stručnom osobom u vezi sa svojim brigama u odgoju djece. Upitnici će biti šifrirani, a šifra koja se povezuje s Vašim imenom bit će dostupna samo istraživačima. U izvještavanju o rezultatima koristit će se samo grupni rezultati, kako se ne bi moglo identificirati Vas ili Vaše dijete. Upitnici će biti pohranjeni na sigurnom mjestu i samo će im ovlašteni istraživači moći pristupiti radi analize. Slično prethodnoj godini istraživanja, Vaše procjene neće biti dostupne učiteljima, kao što ni njihove neće biti dane na uvid Vama ili nekom drugome.

5) Tko je odobrio istraživanje?

Istraživanje je odobrilo Etičko povjerenstvo Odsjeka za psihologiju Filozofskog fakulteta Osijek (referentni broj: 1/4/2017i) te Etičko povjerenstvo za istraživanja Medicinskog fakulteta Osijek. Istraživanje se provodi u skladu s Etičkim kodeksom istraživanja s djecom.

Vaše sudjelovanje iznimno nam je važno za uspjeh ove studije te se nadamo da ćete se odlučiti sudjelovati u istraživanju.

Ako trebate dodatne informacije ili pojašnjenja, molimo Vas da nam se javite (detalji o kontaktima nalaze se pri dnu stranice). Vrlo ćemo rado odgovoriti na sva pitanja koja imate o ovom istraživanju.

Željeli bismo Vam unaprijed zahvaliti na Vašem doprinosu; na temelju podataka koje dobijemo od Vas moći ćemo značajno pridonijeti poboljšanju kvalitete života djece i pomoći Vam u razvijanju potencijala Vaše djece.

HVALA!

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Informirani pristanak roditelja za sudjelovanje u istraživanju odgoja i života djece

Dragi roditelji,

budući da nam je Vaša dobra informiranost o sudjelovanju u ovom istraživanju vrlo značajna, molimo Vas da ispunite ovaj obrazac.

Je li Vam objašnjena svrha istraživanja?	☐ Da ☐ Ne
Jeste li dobili odgovarajuće informacije o istraživanju?	☐ Da ☐ Ne
Imate li kakvih pitanja o istraživanju na koja niste dobili zadovoljavajući odgovor?	☐ Da ☐ Ne
Jeste li bili obaviješteni da su svi podaci koje navedete povjerljivi i anonimni?	☐ Da ☐ Ne
Jeste li razumjeli da je Vaše sudjelovanje dobrovoljno i da možete odustati od sudjelovanja:	
- kada god želite?	☐ Da ☐ Ne
- bez objašnjavanja svojih razloga za odustajanje?	☐ Da ☐ Ne

Pristajem sudjelovati u ovom istraživanju. ☐ Da ☐ Ne

Ime i prezime: _____

Potpis: _____ Datum: _____

Informirani pristanak roditelja za sudjelovanje djeteta u istraživanju odgoja i života djece

Dragi roditelji,

budući da nam je dobra informiranost svakog roditelja o sudjelovanju djeteta u ovom istraživanju vrlo značajna, molimo Vas da ispunite ovaj obrazac.

Je li Vam objašnjena svrha istraživanja?	☐ Da ☐ Ne
Jeste li dobili odgovarajuće informacije o istraživanju?	☐ Da ☐ Ne
Imate li kakvih pitanja o istraživanju na koja niste dobili zadovoljavajući odgovor?	☐ Da ☐ Ne
Jeste li bili informirani da su svi podaci koje Vaše dijete navede povjerljivi i anonimni?	☐ Da ☐ Ne
Jeste li razumjeli da je sudjelovanje Vašeg djeteta dobrovoljno i da ono može odustati od sudjelovanja:	
- kada god želi?	☐ Da ☐ Ne
- bez objašnjavanja svojih razloga za odustajanje?	☐ Da ☐ Ne

Suglasan/suglasna sam da moje dijete sudjeluje u ovom istraživanju.	Da	☐
	Ne	☐
Suglasan/suglasna sam da se mom djetetu uzme bris iz usta u svrhu prikupljanja DNA	Da	☐
	Ne	☐
Dijete je verbalno izrazilo pristanak da mu se uzme bris iz usta	Da	☐
	Ne	☐

Ime djeteta: _____

Ime roditelja/skrbnika: _____

Potpis: _____ Datum: _____