

2024				
Author(s)	Type	Stimulus	Decoding	Notes
Ahmadi, Desain, and Thielen	preprint	modulated Gold codes	reconvolution, CCA	Dynamic stopping
Cantürk and Volosyak	proceedings	m-sequence	CCA	Language model (ChatGPT)
Cabrera Castillos and Dehais	dataset	burst codes		Grating stimuli
Dehais, Cabrera Castillos, Ladouce, and Clisson	preprint	burst codes	Riemannian, logistic regression	Grating stimuli, dry EEG, comfort, eye-strain
Fodor, Herschel, Cantürk, Heisenberg, and Volosyak	article	m-sequence	CCA	Classification certainty feedback
E. Lai, Mai, Ji, Li, and Meng	proceedings	DIBS	filterbank task related component analysis (FBTRCA), LSTM	Asynchronous
Martínez-Cagigal, Álvaro Fernández-Rodríguez, Santamaría-Vázquez, Martín-Fernández, and Hornero	proceedings	non-binary m-sequence	CCA	Learning curve
Y. Miao et al.	article	white noise	TDCA, linear modeling, transfer learning	Minimal calibration, subject-to-subject transfer
Z. Miao, Meunier, Žák, and Grosse-Wentrup	proceedings	m-sequence	EEG2Code, EEGNet, Shallow-ConvNet, DeepConvNet, ShallowNet	Deep learning, transfer-learning, gine-tuning
Narayanan, Ahmadi, Desain, and Thielen	proceedings	modulated Gold codes	CCA	Gaze-independent, covert attention
Qu et al.	article	m-sequence	CCA	Biometrics
Scheppink, Ahmadi, Desain, Tangermann, and Thielen	proceedings	modulated Gold codes	CCA	Auditory, c-AEP
Shi et al.	article	white-noise	TDCA	Maximum information rate
Sun et al.	article	m-sequence	TDCA	Small stimuli (0.5, 1, 2, 3 visual degrees)
Thielen, Sosulski, and Tangermann	proceeding	modulated Gold codes	reconvolution, CCA, UMM	Calibration-free
Thielen, Farquhar, and Desain	dataset	modulated Gold codes		
Velut, Chevallier, Corsi, and Dehais	proceedings	burst codes	CNN, SPDNet, transfer learning	Subject-to-subject transfer
Zheng, Dong, et al.	article	NRBS	FBCCA	Calibration-free, c-VEP versus SSVEP
Zheng, Tian, et al.	dataset	NRBS		c-VEP versus SSVEP

2023				
Author(s)	Type	Stimulus	Decoding	Notes
Ahmadi and Desain	preprint	modulated Gold codes	CCA	Bayesian dynamic stopping
Cabrera Castillos, Ladouce, Darmet, and Dehais	article	m-sequence, burst codes	CNN	
Cabrera Castillos	dataset	m-sequence, burst codes		Eyestrain spatial frequency
Darmet, Ladouce, and Dehais	proceedings	m-sequence	TRCA, EEG2Code, CNN	
Fernández-Rodríguez, Martínez-Cagigal, Santamaría-Vázquez, Ron-Angevin, and Hornero	article	m-sequence	CCA	
Henke et al.	proceedings	m-sequence	CCA	
C. Huang et al.	preprint	white noise	TRCA	Background music
Z. Huang, Liao, Ou, Chen, and Zhang	article	m-sequence	Combined EEGNet	Visual tracking
E. Lai, Mai, and Meng	proceedings	DIBS	FBTRCA, LSTM	Biometrics
Martínez-Cagigal et al.	article	m-sequence, non-binary m-sequences	CCA	fatigue
Martínez-Cagigal, Santamaría-Vázquez, and Hornero	proceedings	non-binary m-sequence	CCA	Eyestrain, fatigue
Moreno-Calderón et al.	article	m-sequence	CCA	Dynamic stopping
Santamaría-Vázquez, Martínez-Cagigal, and Hornero	proceedings	non-binary m-sequence,	EEG-inception	
Thielen	proceedings	m-sequence, APA sequence, Gold codes, Golay sequence, de Bruijn sequence	reconvolution, CCA	Games
Thielen, Cornielje, van der Werff, and Desain	proceedings	m-sequence, Gold codes, Golay sequence, de Bruijn sequence, modulated codes	reconvolution, CCA	Simulated EEG
Thielen, Marsman, Farquhar, and Desain	dataset	modulated Gold codes		Empirical EEG
Volosyak et al.	proceedings	m-sequence	CCA	
Wolf and Götzelmann	article	m-sequence	CCA	
Xu et al.	article	m-sequence	TRCA	

2022				
Author(s)	Type	Stimulus	Decoding	Notes
Dehais et al.	article			Dry EEG, flight simulator, active and passive BCI
Stawicki and Volosyak	article	m-sequence	transfer learning	Session-to-session transfer
Sun, Zheng, Pei, Gao, and Wang	article	shifted Gold code	FBTRCA	120 targets
Ying, Wei, and Zhou	article	m-sequence	Riemannian, transfer learning	Subject-to-subject transfer
Zarei and Asl	article	m-sequence	spatiotemporal beamformer	
Zarei and Asl	article	m-sequence	spatiotemporal beamformer	Improved covariance estimator
Zheng, Pei, Gao, Zhang, and Wang	article	Gold codes	TRCA	Brain-switch
2021				
Author(s)	Type	Stimulus	Decoding	Notes
Kaya, Bohorquez, and Özdamar	article	quasi steady-state	CLAD	
Martínez-Cagigal et al.	article			Review c-VEP
Thielen, Marsman, Farquhar, and Desain	article	modulated Gold codes	reconvolution, CCA	Zero-training
Torres and Daly	article	APA sequence, de Bruijn sequence, Golay sequence, m-sequence, Gold code, Kasami sequence	CCA, ICA, PCA, MLP	Synthetic EEG
Verbaarschot et al.	article	modulated Gold codes	CCA	ALS versus healthy participants

2020					
Author(s)	Type	Stimulus		Decoding	Notes
Behboodi, Mahnam, Marateb, and Rabbani	article	m-sequence, TFO, 6FO		CCA	
Gembler, Rezeika, Benda, and Volosyak	article	m-sequence, sequence	quintary m-	FBCCA	Presentation rate (60, 120, 240), comfort
Gembler, Benda, Rezeika, Stawicki, and Volosyak	article	m-sequence		CCA	Asynchronous, language model
Gembler	dissertation				c-VEP
Gembler, Stawicki, Rezeika, Benda, and Volosyak	proceedings	m-sequence		FBCCA	Asynchronous, multi-session
Z. Huang, Zheng, Wu, and Wang	article	m-sequence		transfer-learning	Subject-to-subject transfer
Volosyak, Rezeika, Benda, Gembler, and Stawicki	article	m-sequence		CCA	SSVEP, SSMVEP, c-VEP, BCI illiteracy
Shirzhiyan et al.	article	periodic, quasi-periodic, chaotic codes		CCA	Fatigue
Turi, Gayraud, and Clerc	article	m-sequence		CCA	Auto-calibration, language model, zero training
Yasinzai and Ider	article	m-sequence, random sequence, SOP sequences		CCA	

2019

Author(s)	Type	Stimulus	Decoding	Notes
Ahmadi	dataset	modulated Gold codes		
Ahmadi	dataset	modulated Gold codes		
Ahmadi, Borhanazad, Tump, Farquhar, and Desain	article	modulated Gold codes	CCA	Low channel count
Başaklar, Tuncel, and İder	article	m-sequence	CCA	Presentation rate (60, 120, 240 Hz)
Borhanazad, Thielen, Farquhar, and Desain	proceedings	modulated Gold codes	CCA	Presentation rate (40, 60, 90, 120 Hz)
Desain, Thielen, van den Broek, and Farquhar	patent	modulated Gold codes	CCA	
Gembler and Volosyak	article	m-sequence	CCA	Language model
Gembler, Stawicki, Rezeika, and Volosyak	proceedings	m-sequence	FBCCA	Presentation rate (30, 60, 120 Hz), age (young, elderly)
Gembler, Stawicki, Saboor, and Volosyak	article	m-sequence	FBCCA	Language model, dynamic stopping
Gembler, Benda, Saboor, and Volosyak	proceedings	m-sequence	FBCCA	Language model, dynamic stopping
Grigoryan, Filatov, and Kaplan	article	m-sequence	CCA	Presentation rate (30, 60, 120 Hz)
Kadioğlu, Yıldız, Closas, Fried-Oken, and Erdoğan	article	m-sequence	Maximum likelihood	Color (green-red), fusion of c-VEP and eye tracker
Kaya, Bohorquez, and Ozdamar	proceedings	quasi steady-state	CLAD	QSSVEP
Kaya, Bohórquez, and Özdamar	article	quasi steady-state	CLAD	QSSVEP
Kaya	dissertation			QSSVEP
Luo and Huang	proceedings	m-sequence	LDA, transfer learning	Subject-to-subject transfer
Matsuno, Itakura, Mizuno, and Mito	proceedings			frequency-hopping VEP
Nagel and Spüler	article	optimized random sequences	EEG2Code	Asynchronous, non-control state
Nagel and Spüler	article	random sequences	EEG2Code	
Nagel	dissertation			c-VEP
Peng and Huang	proceedings	m-sequence	sLDA	For psychological experiments (button presses without behavior)
Shirzhiyan et al.	article	m-sequence, chaotic codes	CCA, spatiotemporal beam-forming	Fatigue
Turi and Clerc	article	m-sequence		Static stopping number of cycles
Zhao, Wang, Liu, Pei, and Chen	article	m-sequence	FBCCA. FBTRCA	Biometrics
Zheng, Wang, Pei, and Chen	proceedings	Gold codes	TRCA	Brain switch

2018				
Author(s)	Type	Stimulus	Decoding	Notes
Başaklar, İder, and Tuncel	proceedings	m-sequence		Presentation rate (60, 120, 240 Hz)
Dimitriadis and Marimpis	article	m-sequence	SVM	PAC, healthy and patients
Gembler, Stawicki, Saboor, et al.	proceedings	m-sequence	CCA	Presentation rate (60, 120, 200 Hz)
Gembler, Stawicki, Rezeika, et al.	proceedings	m-sequence	CCA	Language model
Liu, Wei, and Lu	article	Golay sequence, APA sequence	CCA	
Nagel, Dreher, Rosenstiel, and Spüler	article	m-sequence		Monitor raster latency, P300, SSVEP, c-VEP
Nagel, Rosenstiel, and Spüler	proceedings	optimized random sequences	CCA, regression	
Nagel and Spüler	article	random and optimized sequences	Ridge regression, EEG2Code	
Nezamfar, Mohseni Salehi, Higer, and Erdogmus	article	m-sequence	RDA	Color (green-red), c-VEP versus eye tracker
Spüler and Kurek	article	m-sequence	CCA, SVM	ASSR versus c-AEP
Turi, Gayraud, and Clerc	preprint	m-sequence		Zero-training, language model
Wei et al.	article	grouping modulation, Golay complementary sequences, APA sequence	CCA	
2017				
Author(s)	Type	Stimulus	Decoding	Notes
Aminaka and Rutkowski	chapter	m-sequence	CCA, SVM	Color (green-blue), 40 Hz
Isaksen, Mohebbi, and Puthusserypady	article	m-sequence, Gold code, Barker code	correlation	
Nagel, Rosenstiel, and Spüler	proceedings	m-sequence, random codes	CCA	
Spüler	article	m-sequence	CCA	Dry EEG, static and dynamic stopping
Thielen, Marsman, Farquhar, and Desain	chapter	modulated Gold codes	reconvolution, CCA	Zero-training
Wei, Gong, and Lu	article	grouping modulation, Golay sequence, APA sequence	CCA	
Wittevrongel, Van Wolputte, and Van Hulle	article	m-sequence	beamformer	

## 2016

Author(s)	Type	Stimulus	Decoding	Notes
Desain, Thielen, van den Broek, and Farquhar	patent	modulated Gold codes	CCA	
Isaksen, Mohebbi, and Puthusserypady	proceedings	m-sequence	Barker code, Gold code	
Nezamfar, Salehi, Moghadamfalahi, and Erdogmus	article	m-sequence		FlashType, color (red-green), 110 Hz, language model
Riechmann, Finke, and Ritter	article	m-sequence	SVM (linear)	Color (green-red, black-white), shape, background, 120 Hz, virtual agent
Sato and Washizawa	proceedings	m-sequence	CCA, MLP, Lasso regression, Linear regression	
Thielen, Farquhar, and Desain	proceedings	modulated Gold codes	reconvolution, CCA	
Wei, Feng, and Lu	article	m-sequence	CCA	Stimulus characteristics: size (0.67, 1.7, 2.8, 3.8, 5.4, 7.1, 8.9 dva), color (white, red, green, blue, yellow), proximity (3.8, 4.8, 5.8, 6.8 dva), length (15, 31, 63, 127 bits), lag (2, 4, 6, 8, 10 bits)
Wei, Huang, Li, and Lu	article	m-sequence, Golay sequence	CCA	

2015						
Author(s)		Type	Stimulus	Decoding	Notes	
Aminaka, Rutkowski	Makino, and	proceedings	m-sequence	CCA	Color (green-blue, white-black), presentation rate (30, 40 Hz)	
Aminaka, Rutkowski	Makino, and	proceedings	m-sequence	CCA, SVM	Color (green-blue, white-black), presentation rate (30, 40 Hz), CCA versus SVM	
Aminaka, Rutkowski	Makino, and	proceedings	m-sequence	SVM	Color (green-blue, white-black), presentation rate (30, 40 Hz), pass-band optimization (6-21 Hz)	
Aminaka, Rutkowski	Makino, and	proceedings	m-sequence	SVM	Color (green-blue, white-black), presentation rate (30, 40 Hz), SVM (linear, polynomial, rbf, sigmoid)	
Mohebbi et al.		proceedings	Gold code	correlation	Wheelchair	
Nezamfar, Salehi, and Erdogmus		proceedings	m-sequence	maximum likelihood	Color (red-green, blue-yellow, black-white), presentation rate (30, 60, 110 Hz)	
Sato and Washizawa		proceedings	m-sequence	correlation	Automatic repeat request	
Spüler		proceedings	m-sequence	CCA, SVM	Windows applications	
Thielen, van den Broek, Farquhar, and Desain		article	modulated Gold codes	reconvolution, CCA		
Waytowich and Krusienski		article	m-sequence	CCA	Foveal versus peripheral stimulation	
2014						
Author(s)		Type	Stimulus	Decoding	Notes	
Kapeller et al.		article	m-sequence	CCA, LDA	Invasive, video application	
Tu et al.		article		CSP, SVM, Naive Bayes, LDA	Color (red-green), CTVEP	



2013				
Author(s)	Type	Stimulus	Decoding	Notes
Bohórquez, Lozano, Kao, Toft-Nielsen, and Özdamar	proceedings	temporally jittered SSVEP	CLAD	
Kapeller et al.	proceedings	m-sequence	CCA, LDA	Robot, SSVEP versus c-VEP
Riechmann, Finke, and Ritter	proceedings	hierarchical codebook	SVM	Color (red-green, black-white)
Spüler, Rosenstiel, and Bogdan	proceedings	m-sequence	OCSVM,	Unsupervised online calibration
Spüler, Rosenstiel, and Bogdan	proceedings	m-sequence	OCSVM	Unsupervised online calibration
Spüler, Walter, Rosenstiel, and Bogdan	article	m-sequence	CCA, OCSVM	c-VEP, ERN, P300, TMSEP, CCEP
2012				
Author(s)	Type	Stimulus	Decoding	Notes
Nakanishi and Mitsukura	proceedings	m-sequence, periodic codes	periodicity detection	
Spüler, Rosenstiel, and Bogdan	proceedings	m-sequence	CCA, OCSVM	
Spüler, Rosenstiel, and Bogdan	article	m-sequence	CCA, OCSVM	Online unsupervised adaptation with ERN
2011				
Author(s)	Type	Stimulus	Decoding	Notes
Bin et al.	article	m-sequence	CCA	
S. M. Lai, Zhang, Hung, Niu, and Chang	article			Color (red-green), CTVEP
Nezamfar, Orhan, Purwar, et al.	article	m-sequence	template matching, Bayesian fusion	
Nezamfar, Orhan, Erdogmus, et al.	proceedings	m-sequence	correlation, naive Bayes	Presentation rate (15, 30 Hz)
2009				
Author(s)	Type	Stimulus	Decoding	Notes
Bin, Gao, Wang, Hong, and Gao	article	m-sequence	correlation	ERP versus SSVEP versus c-VEP

<b>2008</b>				
Author(s)	Type	Stimulus	Decoding	Notes
<a href="#">Desain, Farquhar, Blankespoor, and Gielen</a>	proceedings	Gold codes	reconvolution	Auditory
<a href="#">Farquhar, Blankespoor, Vlek, and Desain</a>	proceedings	Gold codes		Auditory
<a href="#">Momose</a>	proceedings	m-sequence		Hybrid P300 and c-VEP
<b>2007</b>				
Author(s)	Type	Stimulus	Decoding	Notes
<a href="#">Momose</a>	proceedings	m-sequence		
<b>2006</b>				
Author(s)	Type	Stimulus	Decoding	Notes
<a href="#">Bohórquez and Özdamar</a>	article	m-sequence	CLAD	Auditory
<b>2002</b>				
Author(s)	Type	Stimulus	Decoding	Notes
<a href="#">Hanagata and Momose</a>	proceedings			
<b>1992</b>				
Author(s)	Type	Stimulus	Decoding	Notes
<a href="#">Sutter</a>	article	m-sequence	correlation	Invasive, ALS patient
<b>1984</b>				
Author(s)	Type	Stimulus	Decoding	Notes
<a href="#">Sutter</a>	proceedings			

## References

- Ahmadi, S. (2019a). *High density EEG measurment*. Radboud University. Retrieved from <https://doi.org/10.34973/psaf-mq72> doi: 10.34973/psaf-mq72
- Ahmadi, S. (2019b). *Sensor tying*. Radboud University. Retrieved from <https://doi.org/10.34973/ehq6-b836> doi: 10.34973/ehq6-b836
- Ahmadi, S., Borhanazad, M., Tump, D., Farquhar, J., & Desain, P. (2019). Low channel count montages using sensor tying for VEP-based BCI. *Journal of Neural Engineering*. Retrieved from <https://doi.org/10.1088/1741-2552/ab4057> doi: 10.1088/1741-2552/ab4057
- Ahmadi, S., & Desain, P. (2023). A model-based dynamic stopping method for c-VEP BCI. In N. Mrachacz-Kersting, J. Collinger, D. Mattia, D. Valeriani, M. Vansteensel, & G. Müller-Putz (Eds.), *Proceedings of the 10th International Brain-Computer Interface Meeting 2023: Balancing Innovation and Translation*. Retrieved from <https://doi.org/10.3217/978-3-85125-962-9-168> doi: 10.3217/978-3-85125-962-9-168
- Ahmadi, S., Desain, P., & Thielen, J. (2024). A bayesian dynamic stopping method for evoked response brain-computer interfacing. *arXiv preprint arXiv:2406.11081*. Retrieved from <https://doi.org/10.48550/arXiv.2406.11081> doi: 10.48550/arXiv.2406.11081
- Aminaka, D., Makino, S., & Rutkowski, T. M. (2015a). Chromatic and high-frequency cVEP-based BCI paradigm. In *2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 1906–1909). Retrieved from <https://doi.org/10.1109/EMBC.2015.7318755> doi: 10.1109/EMBC.2015.7318755
- Aminaka, D., Makino, S., & Rutkowski, T. M. (2015b). Classification accuracy improvement of chromatic and high-frequency code-modulated visual evoked potential-based BCI. In *International Conference on Brain Informatics and Health* (pp. 232–241). Retrieved from [https://doi.org/10.1007/978-3-319-23344-4\\_23](https://doi.org/10.1007/978-3-319-23344-4_23) doi: 10.1007/978-3-319-23344-4\_23
- Aminaka, D., Makino, S., & Rutkowski, T. M. (2015c). EEG filtering optimization for code-modulated chromatic visual evoked potential-based brain-computer interface. In *International Workshop on Symbiotic Interaction* (pp. 1–6). Retrieved from [https://doi.org/10.1007/978-3-319-24917-9\\_1](https://doi.org/10.1007/978-3-319-24917-9_1) doi: 10.1007/978-3-319-24917-9\_1
- Aminaka, D., Makino, S., & Rutkowski, T. M. (2015d). SVM classification study of code-modulated visual evoked potentials. In *2015 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA)* (pp. 1065–1070). Retrieved from <https://doi.org/10.1109/APSIPA.2015.7415435> doi: 10.1109/APSIPA.2015.7415435
- Aminaka, D., & Rutkowski, T. M. (2017). A sixteen-command and 40 Hz carrier frequency code-modulated visual evoked potential BCI. In *Brain-Computer Interface Research* (pp. 97–104). Springer. Retrieved from [https://doi.org/10.1007/978-3-319-64373-1\\_10](https://doi.org/10.1007/978-3-319-64373-1_10) doi: 10.1007/978-3-319-64373-1\_10
- Başaklar, T., İder, Y. Z., & Tuncel, Y. (2018). Effects of high stimulus presentation rate on c-VEP based BCIs. In *2018 Medical Technologies National Congress (TIPTEKNO)* (pp. 1–4). Retrieved from <https://doi.org/10.1088/2057-1976/ab0cee> doi: 10.1088/2057-1976/ab0cee
- Başaklar, T., Tuncel, Y., & İder, Y. Z. (2019). Effects of high stimulus presentation rate on EEG template characteristics and performance of c-VEP based BCIs. *Biomedical Physics & Engineering Express*. Retrieved from <https://doi.org/10.1088/2057-1976/ab0cee> doi: 10.1088/2057-1976/ab0cee
- Behboodi, M., Mahnam, A., Marateb, H., & Rabbani, H. (2020). Optimization of visual stimulus sequence in a brain-computer interface based on code modulated visual evoked potentials. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*. Retrieved from <https://doi.org/10.1109/TNSRE.2020.3044947> doi: 10.1109/TNSRE.2020.3044947
- Bin, G., Gao, X., Wang, Y., Hong, B., & Gao, S. (2009). VEP-based brain-computer interfaces: time, frequency, and code modulations. *IEEE Computational Intelligence Magazine*, 4(4), 22–26. Retrieved from <https://doi.org/10.1109/MCI.2009.934562> doi: 10.1109/MCI.2009.934562
- Bin, G., Gao, X., Wang, Y., Li, Y., Hong, B., & Gao, S. (2011). A high-speed BCI based on code modulation VEP. *Journal of Neural Engineering*, 8(2), 025015. Retrieved from <https://doi.org/10.1088/1741-2560/8/2/025015> doi: 10.1088/1741-2560/8/2/025015
- Bohórquez, J., Lozano, S., Kao, A., Toft-Nielsen, J., & Özdamar, Ö. (2013). Deconvolution and modeling of overlapping visual evoked potentials. In *2013 29th southern biomedical engineering conference* (pp. 31–32). Retrieved from <https://doi.org/10.1109/SBEC.2013.24> doi: 10.1109/SBEC.2013.24
- Bohórquez, J., & Özdamar, Ö. (2006). Signal to noise ratio analysis of maximum length sequence deconvolution of overlapping evoked potentials. *The Journal of the Acoustical Society of America*, 119(5), 2881–2888. Retrieved from <https://doi.org/10.1121/1.2191609> doi: 10.1121/1.2191609

- Borhanazad, M., Thielen, J., Farquhar, J., & Desain, P. (2019). The effect of high and low frequencies in c-VEP BCI. In *8th Graz Brain-Computer Interface Conference 2019*. Retrieved from <https://doi.org/10.3217/978-3-85125-682-6-24> doi: 10.3217/978-3-85125-682-6-24
- Cabrera Castillos, K. (2023). *4-class code-VEP EEG data*. Zenodo. Retrieved from <https://doi.org/10.5281/zenodo.8255618> doi: 10.5281/zenodo.8255618
- Cabrera Castillos, K., & Dehais, F. (2024). *5-class burst c-VEP with dry EEG*. Zenodo. Retrieved from <https://doi.org/10.5281/zenodo.13838406> doi: 10.5281/zenodo.13838406
- Cabrera Castillos, K., Ladouce, S., Darmet, L., & Dehais, F. (2023). Burst c-VEP based BCI: Optimizing stimulus design for enhanced classification with minimal calibration data and improved user experience. *NeuroImage*, 284, 120446. Retrieved from <https://doi.org/10.1016/j.neuroimage.2023.120446> doi: 10.1016/j.neuroimage.2023.120446
- Cantürk, A., & Volosyak, I. (2024). A novel ChatGPT-driven communication aid based on code-modulated visual evoked potentials (cVEP). In *9th Graz Brain-Computer Interface Conference 2024*. Retrieved from <https://doi.org/10.3217/978-3-99161-014-4-008> doi: 10.3217/978-3-99161-014-4-008
- Darmet, L., Ladouce, S., & Dehais, F. (2023). Shortened calibration of code-VEP based BCI by improved deep learning architecture and golden subjects pre-training. In *11th International IEEE EMBS Conference on Neural Engineering*. Retrieved from <https://hal.science/hal-03984091/>
- Dehais, F., Cabrera Castillos, K., Ladouce, S., & Clisson, P. (2024). Leveraging grating-based flickers: A leap toward practical, visually comfortable, and high-performance dry EEG code-VEP BCI. *bioRxiv*, 2024-07. Retrieved from <https://doi.org/10.1101/2024.07.17.603960> doi: 10.1101/2024.07.17.603960
- Dehais, F., Ladouce, S., Darmet, L., Nong, T.-V., Ferraro, G., Torre Tresols, J., ... Labedan, P. (2022). Dual passive reactive brain-computer interface: A novel approach to human-machine symbiosis. *Frontiers in Neuroergonomics*, 3, 824780. Retrieved from <https://doi.org/10.3389/fnrgo.2022.824780> doi: 10.3389/fnrgo.2022.824780
- Desain, P., Farquhar, J., Blankespoor, J., & Gielen, S. (2008). Detecting spread spectrum pseudo random noise tags in EEG/MEG using a structure-based decomposition. In *4th International Brain-Computer Interface Workshop and Training Course 2008*. Retrieved from [https://www.tugraz.at/fileadmin/user\\_upload/Institute/INE/Proceedings/Proceedings\\_BCI\\_Conference\\_2008.pdf](https://www.tugraz.at/fileadmin/user_upload/Institute/INE/Proceedings/Proceedings_BCI_Conference_2008.pdf)
- Desain, P., Thielen, J., van den Broek, P., & Farquhar, J. (2016). *Brain computer interface using broadband evoked potentials*. Google Patents. Retrieved from <https://patents.google.com/patent/WO2016012390A1/en> (US Patent App. 15/328,083)
- Desain, P., Thielen, J., van den Broek, P., & Farquhar, J. (2019). *Brain computer interface using broadband evoked potentials*. Google Patents. (US Patent App. 10/314,508)
- Dimitriadis, S. I., & Marimpis, A. D. (2018). Enhancing performance and bit rates in a brain-computer interface system with phase-to-amplitude cross-frequency coupling: evidences from traditional c-VEP, fast c-VEP, and SSVEP designs. *Frontiers in Neuroinformatics*, 12, 19. Retrieved from <https://doi.org/10.3389/fninf.2018.00019> doi: 10.3389/fninf.2018.00019
- Farquhar, J., Blankespoor, J., Vlek, R., & Desain, P. (2008). Towards a noise-tagging auditory BCI-paradigm. In *4th International Brain-Computer Interface Workshop and Training Course 2008*. Retrieved from [https://www.tugraz.at/fileadmin/user\\_upload/Institute/INE/Proceedings/Proceedings\\_BCI\\_Conference\\_2008.pdf](https://www.tugraz.at/fileadmin/user_upload/Institute/INE/Proceedings/Proceedings_BCI_Conference_2008.pdf)
- Fernández-Rodríguez, Á., Martínez-Cagigal, V., Santamaría-Vázquez, E., Ron-Angevin, R., & Hornero, R. (2023). Influence of spatial frequency in visual stimuli for cVEP-based BCIs: evaluation of performance and user experience. *Frontiers in Human Neuroscience*, 17. Retrieved from <https://doi.org/10.3389/fnhum.2023.1288438> doi: 10.3389/fnhum.2023.1288438
- Fodor, M. A., Herschel, H., Cantürk, A., Heisenberg, G., & Volosyak, I. (2024). Evaluation of different visual feedback methods for brain-computer interfaces (BCI) based on code-modulated visual evoked potentials (cVEP). *Brain Sciences*, 14(8), 846. Retrieved from <https://doi.org/10.3390/brainsci14080846> doi: 10.3390/brainsci14080846
- Gembler, F. (2020). *Parameter optimization for brain-computer interfaces based on visual evoked potentials* (Unpublished doctoral dissertation). Universität Bielefeld.
- Gembler, F., Benda, M., Rezeika, A., Stawicki, P. R., & Volosyak, I. (2020). Asynchronous c-VEP communication tools—efficiency comparison of low-target, multi-target and dictionary-assisted BCI spellers. *Scientific Reports*, 10(1), 1–13. Retrieved from <https://doi.org/10.1038/s41598-020-74143-4> doi: 10.1038/s41598-020-74143-4

- Gembler, F., Benda, M., Saboor, A., & Volosyak, I. (2019). A multi-target c-VEP-based BCI speller utilizing n-gram word prediction and filter bank classification. In *2019 IEEE International Conference on Systems, Man and Cybernetics (SMC)* (pp. 2719–2724). Retrieved from <https://doi.org/10.1109/SMC.2019.8914235> doi: 10.1109/SMC.2019.8914235
- Gembler, F., Rezeika, A., Benda, M., & Volosyak, I. (2020). Five shades of grey: Exploring quintary m-sequences for more user-friendly c-VEP-based BCIs. *Computational Intelligence and Neuroscience*, 2020. Retrieved from <https://doi.org/10.1155/2020/7985010> doi: 10.1155/2020/7985010
- Gembler, F., Stawicki, P., Rezeika, A., Benda, M., & Volosyak, I. (2020). Exploring session-to-session transfer for brain-computer interfaces based on code-modulated visual evoked potentials. In *2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC)* (pp. 1505–1510). Retrieved from <https://doi.org/10.1109/SMC42975.2020.9282826> doi: 10.1109/SMC42975.2020.9282826
- Gembler, F., Stawicki, P., Rezeika, A., Saboor, A., Benda, M., & Volosyak, I. (2018). Effects of monitor refresh rates on c-VEP BCIs. In *International Workshop on Symbiotic Interaction* (pp. 53–62). Retrieved from [https://doi.org/10.1007/978-3-319-91593-7\\_6](https://doi.org/10.1007/978-3-319-91593-7_6) doi: 10.1007/978-3-319-91593-7\_6
- Gembler, F., Stawicki, P., Rezeika, A., & Volosyak, I. (2019). A comparison of cVEP-based BCI-performance between different age groups. In *International Work-Conference on Artificial Neural Networks* (pp. 394–405). Retrieved from [https://doi.org/10.1007/978-3-030-20521-8\\_33](https://doi.org/10.1007/978-3-030-20521-8_33) doi: 10.1007/978-3-030-20521-8\_33
- Gembler, F., Stawicki, P., Saboor, A., Benda, M., Grichnik, R., Rezeika, A., & Volosyak, I. (2018). A dictionary driven mental typewriter based on code-modulated visual evoked potentials (cVEP). In *2018 IEEE International Conference on Systems, Man, and Cybernetics (SMC)* (pp. 619–624). Retrieved from <https://doi.org/10.1109/SMC.2018.00114> doi: 10.1109/SMC.2018.00114
- Gembler, F., Stawicki, P., Saboor, A., & Volosyak, I. (2019). Dynamic time window mechanism for time synchronous VEP-based BCIs—performance evaluation with a dictionary-supported BCI speller employing SSVEP and c-VEP. *PLOS ONE*, 14(6), e0218177. Retrieved from <https://doi.org/10.1371/journal.pone.0218177> doi: 10.1371/journal.pone.0218177
- Gembler, F., & Volosyak, I. (2019). A novel dictionary-driven mental spelling application based on code-modulated visual evoked potentials. *Computers*, 8(2), 33. Retrieved from <https://doi.org/10.3390/computers8020033> doi: 10.3390/computers8020033
- Grigoryan, R., Filatov, D., & Kaplan, A. (2019). High-speed brain-computer communication interface based on code-modulated visual evoked potentials. *Bulletin of Russian State Medical University*(2). Retrieved from <https://doi.org/10.24075/brsmu.2019.019> doi: 10.24075/brsmu.2019.019
- Hanagata, J., & Momose, K. (2002). A method for detecting gazed target using visual evoked potentials elicited by pseudorandom stimuli. In *Proc. 5th asia pacific conf. medical and biological engineering and 11th int. conf. biomedical engineering (icbme)*.
- Henke, L., Rulffs, P., Adepoju, F., Stawicki, P., Cantürk, A., & Volosyak, I. (2023). Investigating the influence of background music on the performance of a cVEP-based BCI. In *2023 IEEE International Conference on Systems, Man, and Cybernetics (SMC)* (pp. 1104–1109). Retrieved from <https://doi.org/10.3390/healthcare11071014> doi: 10.3390/healthcare11071014
- Huang, C., Shi, N., Miao, Y., Chen, X., Wang, Y., & Gao, X. (2023). Visual tracking brain computer interface. *arXiv preprint arXiv:2311.12592*. Retrieved from <https://doi.org/10.48550/arXiv.2311.12592> doi: 10.48550/arXiv.2311.12592
- Huang, Z., Liao, Z., Ou, G., Chen, L., & Zhang, Y. (2023). Authentication using c-vep evoked in a mild-burdened cognitive task. *Frontiers in Human Neuroscience*, 17, 1240451. Retrieved from <https://doi.org/10.3389/fnhum.2023.1240451> doi: 10.3389/fnhum.2023.1240451
- Huang, Z., Zheng, W., Wu, Y., & Wang, Y. (2020). Ensemble or pool: A comprehensive study on transfer learning for c-VEP BCI during interpersonal interaction. *Journal of Neuroscience Methods*, 343, 108855. Retrieved from <https://doi.org/10.1016/j.jneumeth.2020.108855> doi: 10.1016/j.jneumeth.2020.108855
- Isaksen, J., Mohebbi, A., & Puthusserypady, S. (2016). A comparative study of pseudorandom sequences used in a c-VEP based BCI for online wheelchair control. In *2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 1512–1515). Retrieved from <https://doi.org/10.1109/EMBC.2016.7590997> doi: 10.1109/EMBC.2016.7590997
- Isaksen, J., Mohebbi, A., & Puthusserypady, S. (2017). Optimal pseudorandom sequence selection for online c-VEP based BCI control applications. *PLOS ONE*, 12(9), e0184785. Retrieved from <https://doi.org/10.1371/journal.pone.0184785> doi: 10.1371/journal.pone.0184785



- Kadioğlu, B., Yıldız, İ., Closas, P., Fried-Oken, M. B., & Erdoğan, D. (2019). Robust fusion of c-VEP and gaze. *IEEE Sensors Letters*, 3(1), 1–4. Retrieved from <https://doi.org/10.1109/LSSENS.2018.2878705> doi: 10.1109/LSSENS.2018.2878705
- Kapeller, C., Hintermüller, C., Abu-Alqumsan, M., Prückl, R., Peer, A., & Guger, C. (2013). A BCI using VEP for continuous control of a mobile robot. In *2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 5254–5257). Retrieved from <https://doi.org/10.1109/EMBC.2013.6610734> doi: 10.1109/EMBC.2013.6610734
- Kapeller, C., Kamada, K., Ogawa, H., Prueckl, R., Scharinger, J., & Guger, C. (2014). An electrocorticographic BCI using code-based VEP for control in video applications: a single-subject study. *Frontiers in Systems Neuroscience*, 8, 139. Retrieved from <https://doi.org/10.3389/fnsys.2014.00139> doi: 10.3389/fnsys.2014.00139
- Kaya, I. (2019). *High rate quasi-steady-state pattern visual evoked potentials for brain-computer interface* (Unpublished doctoral dissertation). University of Miami.
- Kaya, I., Bohórquez, J., & Özdamar, Ö. (2019). A BCI gaze sensing method using low jitter code modulated VEP. *Sensors*, 19(17), 3797. Retrieved from <https://doi.org/10.3390/s19173797> doi: 10.3390/s19173797
- Kaya, I., Bohorquez, J., & Özdamar, Ö. (2021). BCI performance improvement by special low jitter quasi-steady-state VEP paradigm. *Modern Approaches to Augmentation of Brain Function*, 121–139. Retrieved from [https://doi.org/10.1007/978-3-030-54564-2\\_7](https://doi.org/10.1007/978-3-030-54564-2_7) doi: 10.1007/978-3-030-54564-2\_7
- Kaya, I., Bohorquez, J. E., & Ozdamar, O. (2019). Brain computer interface switch based on quasi-steady-state visual evoked potentials. In *2019 9th international ieee/embs conference on neural engineering (ner)* (pp. 1175–1178).
- Lai, E., Mai, X., Ji, M., Li, S., & Meng, J. (2024). High-frequency discrete-interval binary sequence in asynchronous c-VEP-based BCI for visual fatigue reduction. *IEEE Journal of Biomedical and Health Informatics*. Retrieved from <https://doi.org/10.1109/BIBM58861.2023.10385977> doi: 10.1109/BIBM58861.2023.10385977
- Lai, E., Mai, X., & Meng, J. (2023). High-performance deep neural network pretrained with contrastive learning for asynchronous high-frequency c-VEP detection. In *2023 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)* (pp. 2515–2521). Retrieved from <https://doi.org/10.1109/BIBM58861.2023.10385977> doi: 10.1109/BIBM58861.2023.10385977
- Lai, S. M., Zhang, Z., Hung, Y. S., Niu, Z., & Chang, C. (2011). A chromatic transient visual evoked potential based encoding/decoding approach for brain-computer interface. *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*, 1(4), 578–589. Retrieved from <https://doi.org/10.1109/JETCAS.2011.2178734> doi: 10.1109/JETCAS.2011.2178734
- Liu, Y., Wei, Q., & Lu, Z. (2018). A multi-target brain-computer interface based on code modulated visual evoked potentials. *PLOS ONE*, 13(8), e0202478. Retrieved from <https://doi.org/10.1371/journal.pone.0202478> doi: 10.1371/journal.pone.0202478
- Luo, D., & Huang, Z. (2019). A subject-transfer study on detecting c-VEP. In *2019 Chinese Automation Congress (CAC)* (pp. 2956–2959). Retrieved from <https://doi.org/10.1109/CAC48633.2019.8996478> doi: 10.1109/CAC48633.2019.8996478
- Martínez-Cagigal, V., Santamaría-Vázquez, E., & Hornero, R. (2023). Toward early stopping detection for non-binary c-vep-based bcis: A pilot study. In I. Rojas, G. Joya, & A. Catala (Eds.), *Advances in Computational Intelligence* (pp. 580–590). Cham: Springer Nature Switzerland. Retrieved from [https://doi.org/10.1007/978-3-031-43078-7\\_47](https://doi.org/10.1007/978-3-031-43078-7_47) doi: 10.1007/978-3-031-43078-7\_47
- Martínez-Cagigal, V., Santamaría-Vázquez, E., Pérez-Velasco, S., Marcos-Martínez, D., Moreno-Calderón, S., & Hornero, R. (2023). Non-binary m-sequences for more comfortable brain-computer interfaces based on c-VEPs. *Expert Systems with Applications*, 120815. Retrieved from <https://doi.org/10.1016/j.eswa.2023.120815> doi: 10.1016/j.eswa.2023.120815
- Martínez-Cagigal, V., Thielen, J., Santamaría-Vázquez, E., Pérez-Velasco, S., Desain, P., & Hornero, R. (2021). Brain-computer interfaces based on code-modulated visual evoked potentials (c-VEP): a literature review. *Journal of Neural Engineering*. Retrieved from <https://doi.org/10.1088/1741-2552/ac38cf>
- Martínez-Cagigal, V., Álvaro Fernández-Rodríguez, Santamaría-Vázquez, E., Martín-Fernández, A., & Hornero, R. (2024). Assessing calibration durations for c-VEP-based BCIs: Insights from non-binary patterns and spatial frequency variations. In *9th Graz Brain-Computer Interface Conference 2024*. Retrieved from <https://doi.org/10.3217/978-3-99161-014-4-041> doi: 10.3217/978-3-99161-014-4-041
- Matsuno, S., Itakura, N., Mizuno, T., & Mito, K. (2019). Examination of multi-optioning for cVEP-based BCI by fluctuation of indicator lighting intervals and

- luminance. In *2019 IEEE International Conference on Systems, Man and Cybernetics (SMC)* (pp. 2743–2747). Retrieved from <https://doi.org/10.1109/SMC.2019.8914445> doi: 10.1109/SMC.2019.8914445
- Miao, Y., Shi, N., Huang, C., Song, Y., Chen, X., Wang, Y., & Gao, X. (2024). High-performance c-VEP-BCI under minimal calibration. *Expert Systems with Applications*, 249, 123679. Retrieved from <https://doi.org/10.1016/j.eswa.2024.123679> doi: 10.1016/j.eswa.2024.123679
- Miao, Z., Meunier, A., Žák, M. R., & Grosse-Wentrup, M. (2024). Exploring artificial neural network models for c-VEP decoding in a brain-artificial intelligence interface. In *2024 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)* (pp. 4178–4183). Retrieved from <https://eprints.cs.univie.ac.at/8197/>
- Mohebbi, A., Engelholm, S. K., Puthusserypady, S., Kjaer, T. W., Thomsen, C. E., & Sorensen, H. B. (2015). A brain computer interface for robust wheelchair control application based on pseudorandom code modulated visual evoked potential. In *2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 602–605). Retrieved from <https://doi.org/10.1109/EMBC.2015.7318434> doi: 10.1109/EMBC.2015.7318434
- Momose, K. (2007). Evaluation of an eye gaze point detection method using VEP elicited by multi-pseudorandom stimulation for brain computer interface. In *2007 29th Annual International Conference of the IEEE Engineering in Medicine and Biology Society* (pp. 5063–5066). Retrieved from <https://doi.org/10.1109/IEMBS.2007.4353478> doi: 10.1109/IEMBS.2007.4353478
- Momose, K. (2008). Simultaneous detection method of P300 event-related potentials and eye gaze point using multi-pseudorandom and flash stimulation for brain computer interface. In *2008 30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society* (pp. 666–669). Retrieved from <https://doi.org/10.1109/IEMBS.2008.4649240> doi: 10.1109/IEMBS.2008.4649240
- Moreno-Calderón, S., Martínez-Cagigal, V., Santamaría-Vázquez, E., Pérez-Velasco, S., Marcos-Martínez, D., & Hornero, R. (2023). Combining brain-computer interfaces and multiplayer video games: an application based on c-VEPs. *Frontiers in Human Neuroscience*, 17. Retrieved from <https://doi.org/10.3389/fnhum.2023.1227727> doi: 10.3389/fnhum.2023.1227727
- Nagel, S. (2019). *Towards a home-use BCI: fast asynchronous control and robust non-control state detection* (Unpublished doctoral dissertation). Universität Tübingen.
- Nagel, S., Dreher, W., Rosenstiel, W., & Spüler, M. (2018). The effect of monitor raster latency on VEPs, ERPs and brain-computer interface performance. *Journal of Neuroscience Methods*, 295, 45–50. Retrieved from <https://doi.org/10.1016/j.jneumeth.2017.11.018> doi: 10.1016/j.jneumeth.2017.11.018
- Nagel, S., Rosenstiel, W., & Spüler, M. (2017). Random visual evoked potentials (rVEP) for brain-computer interface (BCI) control. In *7th Graz Brain-Computer Interface Conference 2017*. Retrieved from <https://doi.org/10.3217/978-3-85125-533-1-64> doi: 10.3217/978-3-85125-533-1-64
- Nagel, S., Rosenstiel, W., & Spüler, M. (2018). Finding optimal stimulation patterns for BCIs based on visual evoked potentials. In *Proceedings of the 7th International Brain-Computer Interface Meeting. BCI Society* (pp. 164–165). Retrieved from <https://bcisociety.org/wp-content/uploads/2019/03/2018AbstractBook.pdf>
- Nagel, S., & Spüler, M. (2018). Modelling the brain response to arbitrary visual stimulation patterns for a flexible high-speed brain-computer interface. *PLOS ONE*, 13(10), e0206107. Retrieved from <https://doi.org/10.1371/journal.pone.0206107> doi: 10.1371/journal.pone.0206107
- Nagel, S., & Spüler, M. (2019a). Asynchronous non-invasive high-speed BCI speller with robust non-control state detection. *Scientific Reports*, 9(1), 1–9. Retrieved from <https://doi.org/10.1038/s41598-019-44645-x> doi: 10.1038/s41598-019-44645-x
- Nagel, S., & Spüler, M. (2019b). World's fastest brain-computer interface: combining EEG2Code with deep learning. *PLOS ONE*, 14(9), e0221909. Retrieved from <https://doi.org/10.1371/journal.pone.0221909> doi: 10.1371/journal.pone.0221909
- Nakanishi, M., & Mitsukura, Y. (2012). Periodicity detection for BCI based on periodic code modulation visual evoked potentials. In *2012 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)* (pp. 665–668). Retrieved from <https://doi.org/10.1109/ICASSP.2012.6287971> doi: 10.1109/ICASSP.2012.6287971
- Narayanan, S., Ahmadi, S., Desain, P., & Thielen, J. (2024). Towards gaze-independent c-VEP BCI: A pilot study. In *9th Graz Brain-Computer Interface Conference 2024*. Retrieved from <https://doi.org/10.3217/978-3-99161-014-4-060> doi: 10.3217/978-3-99161-014-4-060
- Nezamfar, H., Mohseni Salehi, S., Higger, M., & Erdogmus, D. (2018). Code-VEP vs. eye tracking: A comparison study. *Brain Sciences*, 8(7), 130. Retrieved from <https://doi.org/10.3390/brainsci8070130> doi: 10.3390/brainsci8070130

- Nezamfar, H., Orhan, U., Erdogmus, D., Hild, K., Purwar, S., Oken, B., & Fried-Oken, M. (2011). On visually evoked potentials in eeg induced by multiple pseudorandom binary sequences for brain computer interface design. In *2011 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)* (pp. 2044–2047). Retrieved from <https://doi.org/10.1109/ICASSP.2011.5946914> doi: 10.1109/ICASSP.2011.5946914
- Nezamfar, H., Orhan, U., Purwar, S., Hild, K., Oken, B., & Erdogmus, D. (2011). Decoding of multichannel EEG activity from the visual cortex in response to pseudorandom binary sequences of visual stimuli. *International Journal of Imaging Systems and Technology*, 21(2), 139–147. Retrieved from <https://doi.org/10.1002/ima.20288> doi: 10.1002/ima.20288
- Nezamfar, H., Salehi, S. S. M., & Erdogmus, D. (2015). Stimuli with opponent colors and higher bit rate enable higher accuracy for c-VEP BCI. In *2015 IEEE Signal Processing in Medicine and Biology Symposium (SPMB)* (pp. 1–6). Retrieved from <https://doi.org/10.1109/SPMB.2015.7405476> doi: 10.1109/SPMB.2015.7405476
- Nezamfar, H., Salehi, S. S. M., Moghadamfalahi, M., & Erdogmus, D. (2016). Flashtype<sup>TM</sup>: A context-aware c-VEP-based BCI typing interface using EEG signals. *IEEE Journal of Selected Topics in Signal Processing*, 10(5), 932–941. Retrieved from <https://doi.org/10.1109/JSTSP.2016.2552140> doi: 10.1109/JSTSP.2016.2552140
- Peng, F., & Huang, Z. (2019). A c-VEP BCI system for psychological experiments. In *2019 12th International Congress on Image and Signal Processing, BioMedical Engineering and Informatics (CISP-BMEI)* (pp. 1–5). Retrieved from <https://doi.org/10.1109/CISP-BMEI48845.2019.8966018> doi: 10.1109/CISP-BMEI48845.2019.8966018
- Qu, H., Zhao, H., Wei, Q., Pei, W., Gao, X., & Wang, Y. (2024). Combining multiple visual stimuli to enhance the performance of VEP-based biometrics. *IEEE Transactions on Information Forensics and Security*. Retrieved from <https://doi.org/10.1109/TIFS.2024.3452628> doi: 10.1109/TIFS.2024.3452628
- Riechmann, H., Finke, A., & Ritter, H. (2013). Hierarchical codebook visually evoked potentials for fast and flexible BCIs. In *2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 2776–2779). Retrieved from <https://doi.org/10.1109/EMBC.2013.6610116> doi: 10.1109/EMBC.2013.6610116
- Riechmann, H., Finke, A., & Ritter, H. (2016). Using a cVEP-based brain-computer interface to control a virtual agent. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 24(6), 692–699. Retrieved from <https://doi.org/10.1109/TNSRE.2015.2490621> doi: 10.1109/TNSRE.2015.2490621
- Santamaría-Vázquez, E., Martínez-Cagigal, V., & Hornero, R. (2023). Bit-wise reconstruction of non-binary visual stimulation patterns from EEG using deep learning: A promising alternative for user-friendly high-speed c-VEP-based BCIs. In I. Rojas, G. Joya, & A. Catala (Eds.), *Advances in Computational Intelligence* (pp. 603–614). Cham: Springer Nature Switzerland. Retrieved from [https://doi.org/10.1007/978-3-031-43078-7\\_49](https://doi.org/10.1007/978-3-031-43078-7_49) doi: 10.1007/978-3-031-43078-7\_49
- Sato, J.-i., & Washizawa, Y. (2015). Reliability-based automatic repeat request for short code modulation visual evoked potentials in brain computer interfaces. In *2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 562–565). Retrieved from <https://doi.org/10.1109/EMBC.2015.7318424> doi: 10.1109/EMBC.2015.7318424
- Sato, J.-i., & Washizawa, Y. (2016). Neural decoding of code modulated visual evoked potentials by spatio-temporal inverse filtering for brain computer interfaces. In *2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 1484–1487). Retrieved from <https://doi.org/10.1109/EMBC.2016.7590990> doi: 10.1109/EMBC.2016.7590990
- Scheppink, H., Ahmadi, S., Desain, P., Tangermann, M., & Thielen, J. (2024). Towards auditory attention decoding with noise-tagging: A pilot study. In *9th Graz Brain-Computer Interface Conference 2024*. Retrieved from <https://doi.org/10.3217/978-3-99161-014-4-059> doi: 10.3217/978-3-99161-014-4-059
- Shi, N., Miao, Y., Huang, C., Li, X., Song, Y., Chen, X., ... Gao, X. (2024). Estimating and approaching the maximum information rate of noninvasive visual brain-computer interface. *NeuroImage*, 120548. Retrieved from <https://doi.org/10.1016/j.neuroimage.2024.120548> doi: 10.1016/j.neuroimage.2024.120548
- Shirzhiyan, Z., Keihani, A., Farahi, M., Shamsi, E., GolMohammadi, M., Mahnam, A., ... Jafari, A. H. (2019). Introducing chaotic codes for the modulation of code modulated visual evoked potentials (c-VEP) in normal adults for visual fatigue reduction. *PLOS ONE*, 14(3), e0213197. Retrieved from <https://doi.org/10.1371/journal.pone.0213197> doi: 10.1371/journal.pone.0213197
- Shirzhiyan, Z., Keihani, A., Farahi, M., Shamsi, E., GolMohammadi, M., Mahnam, A., ... Jafari, A. H. (2020). Toward new modalities in VEP-based BCI applications



- using dynamical stimuli: Introducing quasi-periodic and chaotic VEP-based BCI. *Frontiers in Neuroscience*, 14. Retrieved from <https://doi.org/10.3389/fnins.2020.534619> doi: 10.3389/fnins.2020.534619
- Spüler, M. (2015). A brain-computer interface (BCI) system to use arbitrary Windows applications by directly controlling mouse and keyboard. In *2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 1087–1090). Retrieved from <https://doi.org/10.1109/EMBC.2015.7318554> doi: 10.1109/EMBC.2015.7318554
- Spüler, M. (2017). A high-speed brain-computer interface (BCI) using dry EEG electrodes. *PLOS ONE*, 12(2), e0172400. Retrieved from <https://doi.org/10.1371/journal.pone.0172400> doi: 10.1371/journal.pone.0172400
- Spüler, M., & Kurek, S. (2018). Alpha-band lateralization during auditory selective attention for brain-computer interface control. *Brain-Computer Interfaces*, 5(1), 23–29. Retrieved from <https://doi.org/10.1080/2326263X.2017.1415496> doi: 10.1080/2326263X.2017.1415496
- Spüler, M., Rosenstiel, W., & Bogdan, M. (2012a). One class SVM and canonical correlation analysis increase performance in a c-VEP based brain-computer interface (BCI). In *ESANN*. Retrieved from <https://www.esann.org/sites/default/files/proceedings/legacy/es2012-18.pdf>
- Spüler, M., Rosenstiel, W., & Bogdan, M. (2012b). Online adaptation of a c-VEP brain-computer interface (BCI) based on error-related potentials and unsupervised learning. *PLOS ONE*, 7(12), e51077. Retrieved from <https://doi.org/10.1371/journal.pone.0051077> doi: 10.1371/journal.pone.0051077
- Spüler, M., Rosenstiel, W., & Bogdan, M. (2013a). Unsupervised BCI calibration as possibility for communication in CLIS patients. In *Proceedings of the Fifth International Brain-Computer Interface Meeting* (Vol. 2013). Retrieved from <https://doi.org/10.3217/978-3-85125-260-6-122> doi: 10.3217/978-3-85125-260-6-122
- Spüler, M., Rosenstiel, W., & Bogdan, M. (2013b). Unsupervised online calibration of a c-VEP brain-computer interface (BCI). In *International Conference on Artificial Neural Networks* (pp. 224–231). Retrieved from [https://doi.org/10.1007/978-3-642-40728-4\\_28](https://doi.org/10.1007/978-3-642-40728-4_28) doi: 10.1007/978-3-642-40728-4\_28
- Spüler, M., Walter, A., Rosenstiel, W., & Bogdan, M. (2013). Spatial filtering based on canonical correlation analysis for classification of evoked or event-related potentials in EEG data. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 22(6), 1097–1103. Retrieved from <https://doi.org/10.1109/TNSRE.2013.2290870> doi: 10.1109/TNSRE.2013.2290870
- Stawicki, P., & Volosyak, I. (2022). cVEP training data validation – towards optimal training set composition from multi-day data. *Brain Sciences*, 12(2). Retrieved from <https://doi.org/10.3390/brainsci12020234> doi: 10.3390/brainsci12020234
- Sun, Q., Zhang, S., Dong, G., Pei, W., Gao, X., & Wang, Y. (2024). High-density electroencephalogram facilitates the detection of small stimuli in code-modulated visual evoked potential brain-computer interfaces. *Sensors*, 24(11), 3521. Retrieved from <https://doi.org/10.3390/s24113521> doi: 10.3390/s24113521
- Sun, Q., Zheng, L., Pei, W., Gao, X., & Wang, Y. (2022). A 120-target brain-computer interface based on code-modulated visual evoked potentials. *Journal of Neuroscience Methods*, 109597. Retrieved from <https://doi.org/10.1016/j.jneumeth.2022.109597> doi: 10.1016/j.jneumeth.2022.109597
- Sutter, E. E. (1984). The visual evoked response as a communication channel. In *Proceedings of the IEEE Symposium on Biosensors* (pp. 95–100).
- Sutter, E. E. (1992). The brain response interface: communication through visually-induced electrical brain responses. *Journal of Microcomputer Applications*, 15(1), 31–45. Retrieved from [https://doi.org/10.1016/0745-7138\(92\)90045-7](https://doi.org/10.1016/0745-7138(92)90045-7) doi: 10.1016/0745-7138(92)90045-7
- Thielen, J. (2023). Effects of stimulus sequences on brain-computer interfaces using code-modulated visual evoked potentials: An offline simulation. In I. Rojas, G. Joya, & A. Catala (Eds.), *Advances in Computational Intelligence* (pp. 555–568). Cham: Springer Nature Switzerland. Retrieved from [https://doi.org/10.1007/978-3-031-43078-7\\_45](https://doi.org/10.1007/978-3-031-43078-7_45) doi: 10.1007/978-3-031-43078-7\_45
- Thielen, J., Cornielje, G., van der Werff, F., & Desain, P. (2023). A comparison of stimulus sequences for code-modulated visual evoked potential (c-VEP) based BCI. In N. Mrachacz-Kersting, J. Collinger, D. Mattia, D. Valeriani, M. Vansteensel, & G. Müller-Putz (Eds.), *Proceedings of the 10th International Brain-Computer Interface Meeting 2023: Balancing Innovation and Translation*. Retrieved from <https://doi.org/10.3217/978-3-85125-962-9-139> doi: 10.3217/978-3-85125-962-9-139
- Thielen, J., Farquhar, J., & Desain, P. (2016). Re(con)volution: accurate response prediction for BBVEP-based BCI. In G. R. Müller-Putz, J. E. Huggins, & D. Steyrl (Eds.), *Proceedings of the Sixth International Brain-Computer Interface Meeting: BCI Past, Present, and Future*. Retrieved from <https://doi.org/10.3217/978-3-85125-467-9-34> doi: 10.3217/978-3-85125-467-9-34

- Thielen, J., Farquhar, J., & Desain, P. (2024). *Broad-Band Visually Evoked Potentials: Re(con)volution in Brain-Computer Interfacing*. Radboud University. Retrieved from <https://doi.org/10.34973/1ecz-1232> doi: 10.34973/1ecz-1232
- Thielen, J., Marsman, P., Farquhar, J., & Desain, P. (2017). Re(con)volution: Accurate response prediction for broad-band evoked potentials-based brain computer interfaces. In *Brain-Computer Interface Research* (pp. 35–42). Springer. Retrieved from [https://doi.org/10.1007/978-3-319-64373-1\\_4](https://doi.org/10.1007/978-3-319-64373-1_4) doi: 10.1007/978-3-319-64373-1\_4
- Thielen, J., Marsman, P., Farquhar, J., & Desain, P. (2021). From full calibration to zero training for a code-modulated visual evoked potentials for brain-computer interface. *Journal of Neural Engineering*, 18(5), 056007. Retrieved from <https://doi.org/10.1088/1741-2552/abecef> doi: 10.1088/1741-2552/abecef
- Thielen, J., Marsman, P., Farquhar, J., & Desain, P. (2023). *From full calibration to zero training for a code-modulated visual evoked potentials brain computer interface*. Radboud University. Retrieved from <https://doi.org/10.34973/9txv-z787> doi: 10.34973/9txv-z787
- Thielen, J., Sosulski, J., & Tangermann, M. (2024). Exploring new territory: Calibration-free decoding for c-VEP BCI. In *9th Graz Brain-Computer Interface Conference 2024*. Retrieved from <https://doi.org/10.3217/978-3-99161-014-4-057> doi: 10.3217/978-3-99161-014-4-057
- Thielen, J., van den Broek, P., Farquhar, J., & Desain, P. (2015). Broad-band visually evoked potentials: re(con)volution in brain-computer interfacing. *PLOS ONE*, 10(7), e0133797. Retrieved from <https://doi.org/10.1371/journal.pone.0133797> doi: 10.1371/journal.pone.0133797
- Torres, J. A. R., & Daly, I. (2021). How to build a fast and accurate code-modulated brain-computer interface. *Journal of Neural Engineering*. Retrieved from <https://doi.org/10.1088/1741-2552/abfaac> doi: 10.1088/1741-2552/abfaac
- Tu, Y., Hung, Y. S., Hu, L., Huang, G., Hu, Y., & Zhang, Z. (2014). An automated and fast approach to detect single-trial visual evoked potentials with application to brain-computer interface. *Clinical Neurophysiology*, 125(12), 2372–2383. Retrieved from <https://doi.org/10.1016/j.clinph.2014.03.028> doi: 10.1016/j.clinph.2014.03.028
- Turi, F., & Clerc, M. (2019). Adaptive parameter setting in a code modulated visual evoked potentials BCI. *HAL Open Science*. Retrieved from <https://inria.hal.science/hal-02303562/document>
- Turi, F., Gayraud, N., & Clerc, M. (2018). Zero-calibration cVEP BCI using word prediction: a proof of concept. *arXiv preprint arXiv:1810.03428*. Retrieved from <https://doi.org/10.48550/arXiv.1810.03428> doi: 10.48550/arXiv.1810.03428
- Turi, F., Gayraud, T., & Clerc, M. (2020). Auto-calibration of c-VEP BCI by word prediction. *HAL Open Science*. Retrieved from <https://hal.science/hal-02844024/document>
- Velut, S., Chevallier, S., Corsi, M.-C., & Dehais, F. (2024). Deep Riemannian neural architectures for domain adaptation in burst cVEP-based brain computer interface. In *Esann 2024* (pp. 571–576). Retrieved from <https://hal.science/hal-04720928/>
- Verbaarschot, C., Tump, D., Lutu, A., Borhanazad, M., Thielen, J., van den Broek, P., ... others (2021). A visual brain-computer interface as communication aid for patients with amyotrophic lateral sclerosis. *Clinical Neurophysiology*, 132(10), 2404–2415. Retrieved from <https://doi.org/10.1016/j.clinph.2021.07.012> doi: 10.1016/j.clinph.2021.07.012
- Volosyak, I., Adepoju, F., Stawicki, P., Rulffs, P., Cantürk, A., & Henke, L. (2023). Gender influence on cvep-based bci performance. In I. Rojas, G. Joya, & A. Catala (Eds.), *Advances in Computational Intelligence* (pp. 591–602). Cham: Springer Nature Switzerland. Retrieved from [https://doi.org/10.1007/978-3-031-43078-7\\_48](https://doi.org/10.1007/978-3-031-43078-7_48) doi: 10.1007/978-3-031-43078-7\_48
- Volosyak, I., Rezeika, A., Benda, M., Gembler, F., & Stawicki, P. (2020). Towards solving of the illiteracy phenomenon for VEP-based brain-computer interfaces. *Biomedical Physics & Engineering Express*, 6(3), 035034. Retrieved from <https://doi.org/10.1088/2057-1976/ab87e6> doi: 10.1088/2057-1976/ab87e6
- Waytowich, N. R., & Krusienski, D. J. (2015). Spatial decoupling of targets and flashing stimuli for visual brain-computer interfaces. *Journal of Neural Engineering*, 12(3), 036006. Retrieved from <https://doi.org/10.1088/1741-2560/12/3/036006> doi: 10.1088/1741-2560/12/3/036006
- Wei, Q., Feng, S., & Lu, Z. (2016). Stimulus specificity of brain-computer interfaces based on code modulation visual evoked potentials. *PLOS ONE*, 11(5), e0156416. Retrieved from <https://doi.org/10.1371/journal.pone.0156416> doi: 10.1371/journal.pone.0156416
- Wei, Q., Gong, H., & Lu, Z. (2017). Grouping modulation with different codes for improving performance in cVEP-based brain-computer interfaces. *Electronics Letters*, 53(4), 214–216. Retrieved from <https://doi.org/10.1049/el.2016.4006> doi: 10.1049/el.2016.4006

- Wei, Q., Huang, Y., Li, M., & Lu, Z. (2016). VEP-based brain-computer interfaces modulated by Golay complementary series for improving performance. *Technology and Health Care*, 24(s2), S541–S549. Retrieved from <https://doi.org/10.3233/THC-161180> doi: 10.3233/THC-161180
- Wei, Q., Liu, Y., Gao, X., Wang, Y., Yang, C., Lu, Z., & Gong, H. (2018). A novel c-VEP BCI paradigm for increasing the number of stimulus targets based on grouping modulation with different codes. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 26(6), 1178–1187. Retrieved from <https://doi.org/10.1109/TNSRE.2018.2837501> doi: 10.1109/TNSRE.2018.2837501
- Wittevrongel, B., Van Wolputte, E., & Van Hulle, M. M. (2017). Code-modulated visual evoked potentials using fast stimulus presentation and spatiotemporal beamformer decoding. *Scientific Reports*, 7(1), 15037. Retrieved from <https://doi.org/10.1038/s41598-017-15373-x> doi: 10.1038/s41598-017-15373-x
- Wolf, P., & Götzelmann, T. (2023). VEPdgets: Towards richer interaction elements based on visually evoked potentials. *Sensors*, 23(22), 9127. Retrieved from <https://doi.org/10.3390/s23229127> doi: 10.3390/s23229127
- Xu, H., Hsu, S.-H., Nakanishi, M., Lin, Y., Jung, T.-P., & Cauwenberghs, G. (2023). Stimulus design for visual evoked potential based brain-computer interfaces. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*. Retrieved from <https://doi.org/10.1109/TNSRE.2023.3280081> doi: 10.1109/TNSRE.2023.3280081
- Yasinzai, M. N., & Ider, Y. Z. (2020). New approach for designing cVEP BCI stimuli based on superposition of edge responses. *Biomedical Physics & Engineering Express*, 6(4), 045018. Retrieved from <https://doi.org/10.1088/2057-1976/ab98e7> doi: 10.1088/2057-1976/ab98e7
- Ying, J., Wei, Q., & Zhou, X. (2022). Riemannian geometry-based transfer learning for reducing training time in c-VEP BCIs. *Scientific Reports*, 12(1), 1–15. Retrieved from <https://doi.org/10.1038/s41598-022-14026-y> doi: 10.1038/s41598-022-14026-y
- Zarei, A., & Asl, B. M. (2022a). Automatic detection of code-modulated visual evoked potentials using novel covariance estimators and short-time EEG signals. *Computers in Biology and Medicine*, 105771. Retrieved from <https://doi.org/10.1016/j.compbiomed.2022.105771> doi: 10.1016/j.compbiomed.2022.105771
- Zarei, A., & Asl, B. M. (2022b). Classification of code-modulated visual evoked potentials using adaptive modified covariance beamformer and EEG signals. *Computer Methods and Programs in Biomedicine*, 221, 106859. Retrieved from <https://doi.org/10.1016/j.cmpb.2022.106859> doi: 10.1016/j.cmpb.2022.106859
- Zhao, H., Wang, Y., Liu, Z., Pei, W., & Chen, H. (2019). Individual identification based on code-modulated visual-evoked potentials. *IEEE Transactions on Information Forensics and Security*, 14(12), 3206–3216. Retrieved from <https://doi.org/10.1109/TIFS.2019.2912272> doi: 10.1109/TIFS.2019.2912272
- Zheng, L., Dong, Y., Tian, S., Pei, W., Gao, X., & Wang, Y. (2024). A calibration-free c-VEP based BCI employing narrow-band random sequences. *Journal of Neural Engineering*. Retrieved from <https://doi.org/10.1088/1741-2552/ad3679> doi: 10.1088/1741-2552/ad3679
- Zheng, L., Pei, W., Gao, X., Zhang, L., & Wang, Y. (2022). A high-performance brain switch based on code-modulated visual evoked potentials. *Journal of Neural Engineering*. Retrieved from <https://doi.org/10.1088/1741-2552/ac494f> doi: 10.1088/1741-2552/ac494f
- Zheng, L., Tian, S., Dong, Y., Pei, W., Gao, X., & Wang, Y. (2024). A large dataset for VEP based brain-computer interfaces employing narrow-band code modulation and frequency-phase modulation. *Brain-Apparatus Communication: A Journal of Bacomics*, 3(1), 2383860. Retrieved from <https://doi.org/10.1080/27706710.2024.2383860> doi: 10.1080/27706710.2024.2383860
- Zheng, L., Wang, Y., Pei, W., & Chen, H. (2019). A fast brain switch based on multi-class code-modulated VEPs. In *2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 3058–3061). Retrieved from <https://doi.org/10.1109/EMBC.2019.8857617> doi: 10.1109/EMBC.2019.8857617

## Glossary

**6FO** 6 factor optimum. 4

**ALS** amyotrophic lateral sclerosis. 3, 10

**APA** almost perfect auto-correlation. 2, 3, 6

**ASSR** auditory steady-state response. 6

**BCI** brain computer interfacing. 4

**c-AEP** code-modulated auditory evoked potential. 1, 6

**c-VEP** code-modulated visual evoked potential. 1–6, 9, 10

**CCA** canonical correlation analysis. 1–9

**CCEP** contrico-cortical evoked potential. 9

**CLAD** continuous loop averaging deconvolution. 3, 5, 9, 10

**CNN** convolutional neural network. 1, 2

**CSP** common spatial patterns. 8

**CTVEP** chromatic transient visual evoked potential. 8, 9

**DIBS** discrete interval binary sequence. 1, 2

**EEG** electroencephalography. 1–3, 6

**ERN** error related negativity. 9

**ERP** event related potential. 9

**FBCCA** filterbank canonical correlation analysis. 1, 4, 5

**FBTRCA** filterbank task related component analysis. 1–3

**ICA** independent component analysis. 3

**LDA** linear discriminant analysis. 5, 8, 9

**LSTM** long short term memory. 1, 2

**MLP** multilayer perceptron. 3, 7

**NRBS** narrow-band random sequences. 1

**OCSVM** one class support vector machine. 9

**PAC** phase to amplitude coupling. 6

**PCA** principal component analysis. 3

**QSSVEP** quasi steady-state visual evoked potential. 5

**RDA** regularized discriminant analysis. 6

**sLDA** shrinkage linear discriminant analysis. 5

**SOP** superposition optimized pulse. 4

**SSMVEP** steady state motion visual evoked potential. 4

**SSVEP** steady state visual evoked potential. 1, 2, 4, 6, 9

**SVM** support vector machine. 6–9

**TDCA** task discriminative component analysis. 1

**TFO** time-factor optimum. 4

**TMSEP** transcranial magnetic stimulation evoked potential. 9

**TRCA** task related component analysis. 2, 3, 5

**UMM** unsupervised mean difference maximization. 1

**VEP** visual evoked potential. 5