

# Toward a Classification of Chronotype Questionnaires

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**Purpose:** Chronotyping is a key methodology for assessing individual differences in human adaptation to the 24-h periodicity of geophysical and social environments. Throughout the 50-yr period of publications of chronotype questionnaires, there has been steady growth in their number and diversity. Therefore, it is becoming increasingly difficult to determine which questionnaires can be optimally applied to address a given research question. Consequently, this study aimed to develop a structured system for classifying and comparing chronotype questionnaires.

**Methods:** A search in two bibliographic databases and 8 previously published reviews yielded 75 chronotype questionnaires. The properties of these questionnaires were defined and used for their classification and comparison.

**Results:** Of 75 identified questionnaires, 60 and 15 were designed for only chronotype and chronotype and something else assessment, respectively. The set of 20 questionnaire and questionnaire scale properties was proposed. These properties were used to classify the questionnaires to allow the distinction of any of the questionnaires from other questionnaires.

**Conclusion:** The proposed structured system of questionnaire classification can help in navigating between numerous published questionnaires. Using this system, an optimal instrument for a given research purpose can be chosen and properties of yet-unconstructed questionnaires and scales can be predicted.

**The Plain Language Summary:** Chronotype refers to the behavior manifestations of individual differences in adaptation to the 24-h periodicity of geophysical and social environments. Chronotype questionnaires are permanently growing in number and diversity throughout the 50-yr period of their scientific publications. These questionnaires often have different aims, use different assessment methodologies, and, therefore, are not interchangeable. Given that some researchers would be confused about the different concepts behind these questionnaires, it is essential to determine what instrument to choose for a given research purpose. A system of questionnaire classification can help to navigate between numerous published questionnaires for choosing an optimal instrument for assessment of individual differences in a given study. Moreover, it can help to predict the properties of yet-unconstructed questionnaires. A system based on a set of 20 properties of questionnaires and questionnaire-scales was proposed. It might be used for choosing an optimal instrument for assessment of individual differences in the domain of chronobiology and sleep science and predicting properties of new questionnaires and new scales of published questionnaires.

**Keywords:** morningness-eveningness, chronotyping, individual variation, self-assessment, classification

## Introduction

The façade of the Social Science Research Building of the University of Chicago bears Lord Kelvin's dictum: "If you cannot measure, your knowledge is meager and unsatisfactory". This dictum refers to his lecture titled "Electrical Units of Measurement" delivered on May 3, 1883, in which he highlighted the necessity of quantitative, numerical data for scientific understanding, suggesting that knowledge lacking measurement is, at best, a preliminary stage of science.<sup>1</sup> Indeed, measurement is considered a hallmark of scientific enterprise. A valid and reliable measurement is critical in any field of science, including research on individual differences in the domains of chronobiology and sleep.<sup>2,3</sup> Chronotypes are the behavior manifestations of individual differences in adaptation to the 24-h periodicity of geophysical and social environments. The first scientifically recognized dimension of such differences in human behavior was an individual's

preference for either the early or late phase of the daily rhythmicity of sleep-wakefulness and rest-work. In 1976, Östberg, in co-authorship with Horne, published the first English-language scale, the Morningness-Eveningness Questionnaire (MEQ).<sup>4</sup> It was soon translated into a dozen languages and remains the most popular scale for assessment of individual variation in the field of sleep and biological rhythm research (Table S1).

This questionnaire encouraged to use the same methodology to construct several other scales for the self-assessment of morningness-eveningness. The earliest of such scales are the 7-item Diurnal Type Scale (DTS),<sup>5</sup> one of the two scales of the 16-item Marburger questionnaire (MQ),<sup>6</sup> and the 13-item Composite Scale of Morningness (CSM).<sup>7</sup>

Soon after the publication of the MEQ in 1979, Folkard, Monk and Lobban<sup>8</sup> proposed the first questionnaire instrument for the multi-dimensional (multi-scale) self-assessment of individual differences in daily rhythms. They suggested that morningness-eveningness is not the only chronobiological characteristic of individuals that determines the success or failure of biological adaptation to night and shift work. Factor analysis of responses to the initially proposed list of 20 items of their Circadian-Type Questionnaire (CTQ)<sup>8</sup> yielded three factorial dimensions. One dimension was interpreted as a well-established construct named “morningness-eveningness,” while two other dimensions were named “rigidity-flexibility” (of sleeping habits) and “languidness-vigorousness” (or “inability-ability to overcome drowsiness”).<sup>8</sup>

Later, such a multidimensional approach to chronotyping<sup>8</sup> was applied for the development of several other questionnaires including the 16-item Chronotype Questionnaire (ChQ)<sup>9</sup> and the 40-item Sleep-Wake Pattern Assessment Questionnaire (SWPAQ-40).<sup>10</sup>

After five decades of intensive research, chronotype remains the central concept in studies of individual variation in the fields of chronobiology, chronomedicine, chronopsychology, and sleep-wake regulating mechanisms. Therefore, assessment of chronotypes is a key methodology for studying the differences between people in their capacity to adapt to the 24-h cyclicity of their environment. However, a scientific consensus has not yet been reached on the method of ranking and typing people according to the dimensions of individual variation in daily patterns of performance, sleepiness and sleep-wakefulness.<sup>3</sup> The concepts behind questionnaires used to assess chronotypes are often profoundly different. Particularly, some researchers follow the MEQ<sup>4</sup> approach to chronotyping that suggests that people can be ranked along the only morningness-eveningness (or, in other words, earliness-lateness dimension), while some other follow the CTQ<sup>8</sup> strategy suggesting importance of more complex, multidimensional chronotyping.<sup>2,3,11,12</sup>

It seems that the process of developing questionnaires within the framework of various concepts was intensified in recent years. The examples of questionnaires published in the last decade are the 15-item Morningness–Eveningness–Stability Scale improved (MESSi),<sup>11</sup> the 168-item Sleep-Wake Adaptability Test (SWAT-168),<sup>12</sup> the Athlete Sleep Screening Questionnaire (ASSQ),<sup>13</sup> the 15-item Mood Rhythm Instrument (MRhI),<sup>14</sup> the 30-item Morningness-eveningness Exercise Preference Questionnaire (MEEPQ),<sup>15</sup> the 10-item Francis Owl-Lark Indices (FOLI),<sup>16</sup> the Single-Item Chronotyping (SIC),<sup>17</sup> the Sleep, Circadian Rhythms, and Mood (SCRAM) questionnaire,<sup>18</sup> and a series of chrononutrition questionnaires, such as the Chrononutrition profile-questionnaire (CPQ-M),<sup>19</sup> the Food Timing Questionnaire and Food Timing Screener (FTQ and FTS, respectively),<sup>20</sup> the ChronoNutrition Questionnaire (CNQ),<sup>21</sup> and the Chrono-Nutrition Behavior Questionnaire (CNBQ).<sup>22</sup> Therefore, it is unlikely that the attempts to develop new chronotype questionnaires are coming to the end.

The available chronotype questionnaires often have different aims and use different assessment methodologies.<sup>23</sup> Some of them cannot be interchangeably applied in sleep and biological rhythm study. Since researchers can be confused about the different concepts behind these questionnaires, it is essential to know what instrument to choose for a given research purpose.<sup>23</sup>

To our knowledge, the relationships and conceptual and methodological differences between numerous chronotype questionnaires have not been clarified so far in the framework of a single structured system. Therefore, the following two questions arise: Is it possible to create a system, something like “questionnaire identifier”, to help to 1) choose an optimal instrument for assessing individual differences in a chronobiological and sleep study and 2) determine whether such an instrument is still missing and might be constructed to fill the gap between the already constructed questionnaires? Consequently, the purpose of this paper was to propose such a structured system for facilitating comparisons of basic properties of chronotype questionnaires. The purpose of this system can be to help navigate between numerous

questionnaires without much effort for choosing the right instrument and for uncovering empty territories in the questionnaire landscape and predicting the unique properties of yet-unconstructed questionnaires and scales.

Here, a property-based system of questionnaire classification was proposed. Such a system provides the possibility to navigate between numerous questionnaires without much effort, particularly, without inspecting the content of each questionnaire. A list of chronotype questionnaires was created via a literature search, properties of these questionnaires and their scales were defined, criteria for categorization of each of these properties were suggested, and the examples of such categorization of the identified questionnaires as well as the examples of comparison of questionnaires on their properties were presented.

## Materials and Methods

### Identification of Chronotype Questionnaires

The main aim of the literature search was to identify publications reporting the results of the development and/or application of chronotype questionnaires in human sleep and biological rhythm research. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines for a search of published questionnaires were used.<sup>24</sup>

A questionnaire was included in the list of chronotype questionnaires when the whole questionnaire or, at least, one of its separate scales was designed to assess behavior manifestations of diurnal rhythms including timing of the sleep-wake cycle and times of feeling sleepy-alert. Questionnaires developed to assess general sleep quality and problems were not searched. PRISMA-informed identification of chronotype questionnaires included two following steps.

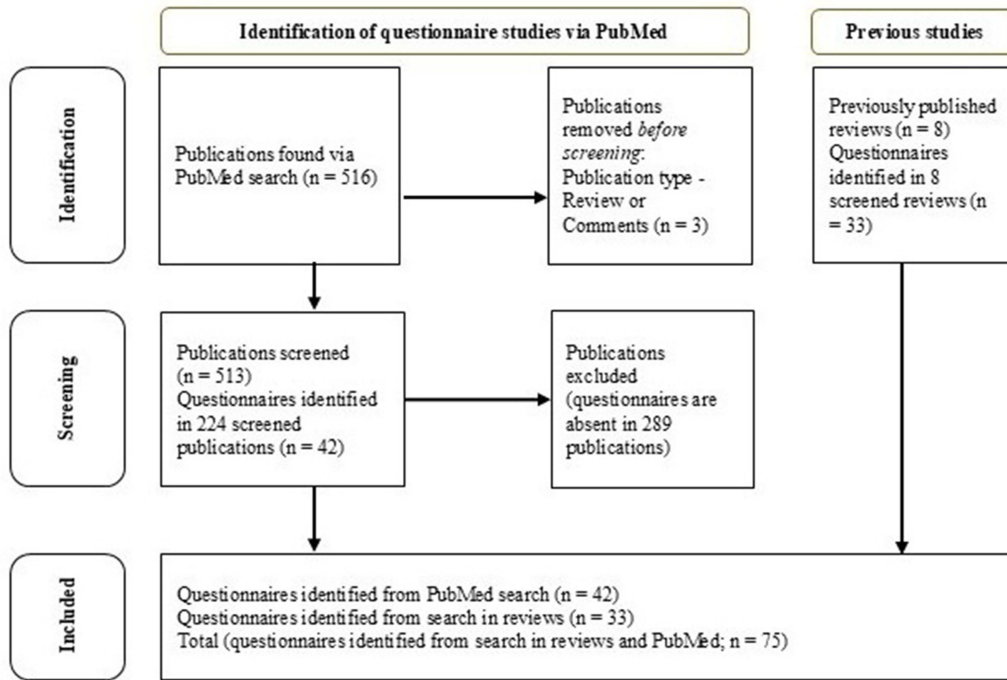
First, the PubMed bibliographic database was searched for publications of chronotype questionnaires from inception to 1/10/2025. The title, abstract and method section were examined to find such questionnaire names and its reference. Previously published reviews on chronotype questionnaires were also manually searched to identify additional questionnaires (Figure 1A). A total of 42 questionnaires were identified by searching in 224 of 516 publications found via a PubMed search using the following search terms: (((Chronotype [Title/Abstract] OR Diurnal [Title/Abstract] OR Morningness-Eveningness [Title/Abstract] OR Morning preference [Title/Abstract] OR Evening preference [Title/Abstract]) AND (Scale [Title/Abstract] OR Questionnaire [Title/Abstract] OR Inventory [Title/Abstract])) AND (Validation [Title/Abstract] OR Validity [Title/Abstract] OR Psychometric [Title/Abstract] OR Reliability [Title/Abstract] OR Construction [Title/Abstract] OR Development [Title/Abstract])). Additionally, 8 reviews (Cavallera and Giudici,<sup>25</sup> Di Milia et al,<sup>2</sup> Almoosawi et al,<sup>26</sup> Tonetti et al,<sup>27</sup> Putilov et al,<sup>17</sup> Vidueira et al,<sup>28</sup> Coelho et al,<sup>29</sup> and Buest de Mesquita Silva et al<sup>30</sup>) were searched for questionnaires missed in the PubMed search. This review search yielded 33 chronotype questionnaires in addition to 42 questionnaires identified in the PubMed search (Figure 1A and Table S1).

Second, the Scopus bibliographic database was searched for publications of chronotype questionnaires from inception to 31/12/2025 to ensure that none of the published questionnaires was missed in the previous search in PubMed database and 8 reviewers (Figure 1A and Table S1). The search terms were the same as in the PubMed search: ((Chronotype OR Diurnal OR Morningness-Eveningness OR Morning preference OR Evening preference) AND (Scale OR Questionnaire OR Inventory)) AND (Validation OR Validity OR Psychometric OR Reliability OR Construction OR Development). A total of 35 questionnaires were identified by searching in 154 of 207 publications found by screening their titles, abstracts and method section via this Scopus search (Figure 1B and Table S1). Compared to the results of PubMed search, 7 more questionnaires were found, but 14 questionnaires were missed. The remaining 26 questionnaires were previously found in the mentioned above 8 reviewers (Figure 1B and Table S1). Thus, this additional search in Scopus bibliographic database did not yield missed questionnaires.

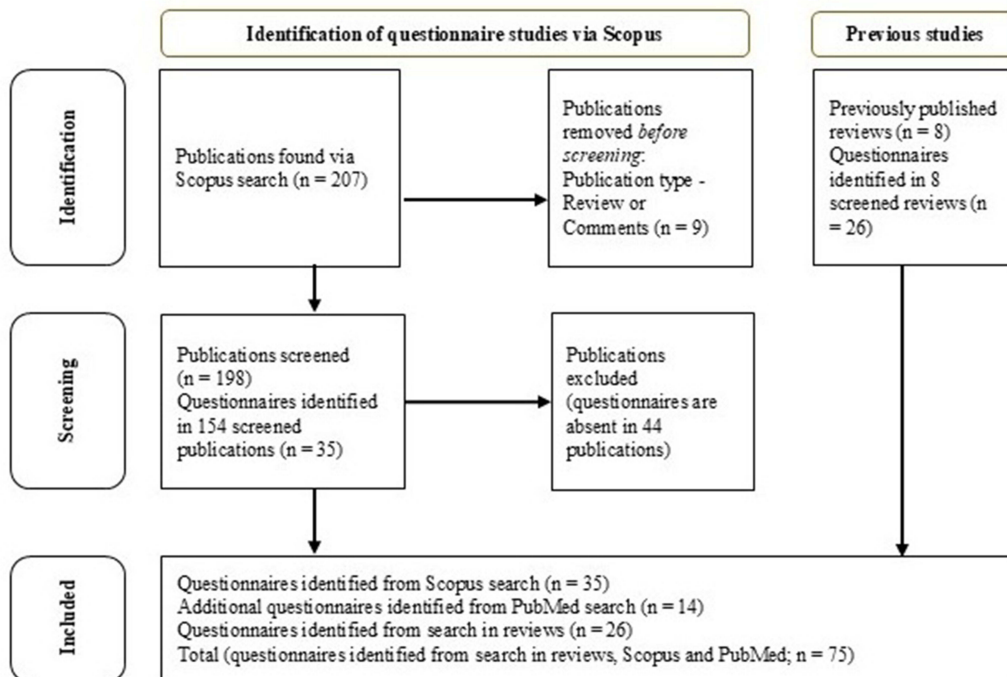
### Classification of Chronotype Questionnaires

After identification of chronotype questionnaires, their content was examined to 1) briefly describe each of the identified questionnaires (Table S2), 2) determine relationships between new and previously published questionnaires (Tables S3 and 1), 3) propose a set of 11 properties of these questionnaires (Tables S4 and 2) and 9 properties of their scales (Tables S5 and 3), 4) categorize these properties and provide examples of these categories (Tables S4 and S5, and 2–4), and 5) illustrate the prospects of comparison of questionnaires on their properties (Tables S6 and S7 and 5 and 6).

### (A) Identification of chronotype questionnaires via PubMed



### (B) Identification of chronotype questionnaires via Scopus



**Figure 1** PRISMA flow diagram illustrating the steps of PRISMA-informed identification of 75 chronotype questionnaires in PubMed (A) and Scopus databases (B) with additional search in reviews.

## Results

### A List of Identified Questionnaires

In total, 75 chronotype questionnaires were identified through a search of publications in two databases and in previously published papers, including 8 reviews on chronotypes and methods of their self-assessment (Figure 1).

Table S1 lists the 42 questionnaires identified in 224 of the 516 publications in PubMed, 35 questionnaires identified in 154 of 207 publications in Scopus, and the remaining questionnaires identified in 8 reviewers. Most frequently used questionnaires (ie., at least 13 publications, ##1-6) were the MEQ,<sup>4</sup> 32-item Munich Chronotype Questionnaire (MCTQ),<sup>31</sup> 5-item reduced Morningness-Eveningness Questionnaire (rMEQ),<sup>32</sup> CSM,<sup>7</sup> 10-item Morningness-Eveningness Scale for Children (MESC),<sup>33</sup> and MESSi.<sup>11</sup> The 27-item Children's Chronotype Questionnaire (CCTQ)<sup>34</sup> was the 7<sup>th</sup> in the PubMed search (12 publications), but only 8<sup>th</sup> in the Scopus search (6 publications). Most of other questionnaires (##8-42 in the PubMed search and ##9-35 in the Scopus search) were rarely used in the identified publications (Table S1).

Table S2 includes a brief description of each of the 75 identified questionnaires and its primary reference. Tables S3 and 1 (that is the reduced version of Table S3) show the results of grouping these questionnaires in accord with relationships between them. In Table 1, this list was shortened to 30 questionnaires by 1) including only questionnaires

**Table 1** Grouping Chronotype Questionnaires in Families and Subfamilies

#	Family or Isolate	Subfamily	#.Abbreviation-# of items	Number of Items and Name (Abbreviation, Yr, and Author(S))
1	1.1.MEQ	1.1.1.MEQ	1.1.1.1.MEQ-19	The 19-item Morningness-Eveningness Questionnaire (MEQ; 1976, Horne, Ostberg) <sup>4</sup>
2		1.1.2.rMEQ	1.1.2.1.rMEQ-1	The 19 <sup>th</sup> item of MEQ (MEQ19th; 1976, Horne, Ostberg) <sup>4</sup>
3			1.1.2.2.rMEQ-5	The 5-item reduced MEQ (rMEQ; 1990, Adan, Almirall) <sup>32</sup>
4	1.2.DTS	1.2.1.DTS	1.2.1.1.DTS-7	The 7-item Diurnal Type Scale (DTS; 1980, Torsvall & Åkerstedt) <sup>5</sup>
5	1.3.CSM	1.3.1.CSM	1.3.1.1.CSM-13	The 13-item Composite Scale of Morningness (CSM; 1989, Smith et al) <sup>7</sup>
6		1.3.4.MA	1.3.4.1.MA-5	The 5-item Morning Affect factor (MA factor; 2005, Caci et al) <sup>35</sup>
7		1.3.5.PS	1.3.5.1.PS-12	The 12-item Early-Late Preferences Scale (PS; 2002, Smith et al) <sup>36</sup>
8	1.4.STQ	1.4.1.STQ	1.4.1.1.STQ-18	The 18-item Sleep Timing Questionnaire (STQ; 2003, Monk et al) <sup>37</sup>
9		1.4.2.MCTQ	1.4.2.1.MCTQ-32	The 32-item Munich Chronotype Questionnaire (MCTQ; 2003, Roenneberg et al) <sup>31</sup>
10		1.4.3.PD	1.4.3.1.PD-2	The two-item Perfect Day (PD; 2017, Gross et al) <sup>38</sup>
11	1.6.MRhl	1.6.1.MRhl	1.6.1.1.MRhl-15	The 15-item Mood Rhythm Instrument (MRhl; 2016, de Souza et al) <sup>14</sup>
12	1.8.SACL	1.8.1.SACL	1.8.1.1.SACL-13	The 13-item Scale for Assessment of Circadian Lateness (SACL; 2005, Putilov, Putilov) <sup>39</sup>
13	1.9.FOLI	1.9.1.FOLI	1.9.1.1.FOLI-10	The 10-item Francis Owl-Lark Indices (FOLI; 2021, Francis et al) <sup>16</sup>
14	2.1.CTQ	2.1.1.CTQ	2.1.1.1.CTQ-20	The 20-item Circadian-Type Questionnaire (CTQ; 1979, Folkard et al) <sup>8</sup>
15			2.1.1.3.rCTI-11	The 11-item Circadian Type Inventory-revised (CTI-r; 2005, Di Milia et al) <sup>40</sup>
16		2.1.2.CAPS	2.1.2.1.CAPS-38	The 38-item Circadian Amplitude and Phase Scale (CAPS; 2011, Di Milia et al) <sup>41</sup>
17	2.2.ChQ	2.2.1.ChQ	2.2.1.1.ChQ-16	The 16-item Chronotype Questionnaire (ChQ; 2011, Ogińska) <sup>9</sup>
18			2.2.1.2.SCAS-8	The 8-item Revised Subjective Amplitude Scale (SCAS; 2017, Ogińska et al) <sup>42</sup>
19		2.2.2.CCQ	2.2.2.1.CCQ-16	The 16-item Caen Chronotype Questionnaire (CCQ; 2013, Dosseville et al) <sup>43</sup>
20	2.3.CIRENS	2.3.1.CIRENS	2.3.1.1.CIRENS-3	The three-item CIRcadian ENergy Scale (CIRENS; 2011, Ottoni et al) <sup>44</sup>
21	2.4.MESSi	2.4.1.MESSi	2.4.1.1.MESSi-15	The 15-item Morningness-Eveningness-Stability Scale improved (MESSi; 2016, Randler et al) <sup>11</sup>
22	2.5.MQ	2.5.1.MQ	2.5.1.1.MQ-16	The 16-item Marburger questionnaire (MQ; 1981, Moog) <sup>6</sup>
23		2.5.2.SRM	2.5.2.1.SRM-17	The 17-item The Social Rhythm Metric (SRM; 1990, Monk et al) <sup>45</sup>
24	2.6.VJT	2.6.1.VJT	2.6.1.1.VJT-19	The 19-time point Visuo-verbal Judgment Task (VJT; 2015, Marcoen et al) <sup>46</sup>
25		2.6.2.SIC	2.6.2.1.SIC-1	The Single-Item Chronotyping (SIC; 2021, Putilov et al) <sup>17</sup>
26	2.7.SWPAQ	2.7.1.SWPAQ	2.7.1.1.SWPAQ-40	The 40-item Sleep-Wake Pattern Assessment Questionnaire (SWPAQ-40; 1990, Putilov) <sup>10</sup>
27			2.7.1.2.SWPAQ-72	The 72-item SWPAQ (SWPAQ-72; 2007, Putilov) <sup>47</sup>
28		2.7.2.SWAT	2.7.2.1.SWAT-168	The 168-item Sleep-Wake Adaptability Test (SWAT-168; 2016, Putilov) <sup>12</sup>
29			2.7.2.2.rSWAT-60	The 60-item SWAT (SWAT-60; 2021, Putilov) <sup>48</sup>
30	2.8.LOCI	2.8.1.LOCI	2.8.1.1.LOCI-38	The 38-item Lark-Owl (Chronotype) Indicator (LOCI; 1998, Roberts) <sup>49</sup>

**Notes.** The list of 30 of 75 identified questionnaires. Reduced by excluding reduced versions with similar properties and addressing other than unspecified adult study participants, ie., such a reduction was based on Property 1a. Construct (questionnaire) for (assessing) and 1b. Group (questionnaire for assessing) in (study participants). The questionnaires can be traced back to the concepts behind just two pioneer questionnaires: the MEQ<sup>4</sup> and CTQ.<sup>8</sup> 1. and 2. Questionnaires for assessing only the phase parameter of diurnal rhythm (1...) and for assessing also or only other than phase parameter(s) (2...), respectively; 1-30 – numbers were assigned to questionnaires in this table and Tables 2–6. See Tables S1–S3 for the full list of the questionnaires.

for assessing unspecified adult populations and 2) excluding questionnaires for assessments of both chronotype and other than chronotype states/traits/abilities (see the notes in Table 1).

The relationships between questionnaires are mentioned in their brief descriptions (Table S2). Such relationships usually include the reduction, extension, and mixing of previously published scales; their adaptation to a specific population; results of editing or recontextualization of all or some of the primary questionnaire items; modification of response options; and reversal of scoring (Table S2). Related questionnaires were included in the subfamilies and families. As a rule, questionnaires of different subfamilies also differ in the conceptualization of assessed constructs(s) and/or in several questionnaire properties (Tables 1 and S2, and S3).

Although some questionnaires can be viewed as isolates, it seems that the basic concepts behind any of 60 identified questionnaires for assessing chronotype can be traced back to the conceptualizations introduced in two pioneer questionnaires for self-assessment of either a morningness-eveningness construct or several sleep-wake adaptabilities, the MEQ<sup>4</sup> and the CTQ,<sup>8</sup> respectively (Tables 1 and S2 and S3).

### Properties Proposed for Classification of Questionnaires

To create a structural system for the classification of published and future chronotype questionnaires, a set of 20 questionnaires and questionnaire scale properties were defined (Tables S4 and S5 of Supplementary Materials 1; see also for more details “Code-book: Decision Rules for the 20 Properties” in Supplementary Materials 2). The following 11 properties were included in the subset of the questionnaire properties (1a-5b), and each of these properties was represented by two or more categories (see also Supplementary Materials 2 for more details):

1a. Construct (questionnaire for assessing). Two categories include assessing chronotype and chronotype and something else (they were abbreviated in Tables 2–4 as Ch and Ch+, respectively). Only the questionnaires assigned to the 1<sup>st</sup> category were further classified (n = 60), while the questionnaires assigned to the 2<sup>nd</sup> category were not included in the present classification (n = 15; see also Supplementary Materials 2 for “Code-book: Decision Rules for the 20 Properties”).

1b. Group (questionnaire for assessing in study participants). Six categories include 1) adults, unspecified, 2) adults, language adaptation, 3) adults, patients, 4) adults, exercising or sportsmen, 5) shiftworkers, and 6) children and/or adolescents (abbreviated in Tables 2–4 as AN, AL, AP, AS, SW, and CA, respectively). Given that the tables listing 60

**Table 2** Properties of Chronotype Questionnaires

#	#.Abbreviation- # of items	2a. Size	2b. Items	3a. Parameter	3b. Scales	4a. Variation	4b. Output	4c. Clock h	5a. Behavior	5b. Interval
1	1.1.1.1.MEQ-19	Pr	19	Ph	1	TL	Sc	Ch+	Act+Pre	T+W
2	1.1.2.1.rMEQ-1	Re	1	Ph	<1	Ty	Sc	Ch-	Pre	W
3	1.1.2.2.rMEQ-5	Re	5	Ph	1	TL	Sc	Ch+	Act+Pre	T+W
4	1.2.1.1.DTS-7	Pr	7	Ph	1	TL	Sc	Ch+	Act+Pre	T+W
5	1.3.1.1.CSM-13	Pr	13	Ph	1	TL	Sc	Ch+	Act+Pre	T+W
6	1.3.4.1.MA-5	Re	5	Ph	1	TL	Sc	Ch-	Act+Pre	T
7	1.3.5.1.PS-12	Fu	12	Ph	1	TL	Sc	Ch-	Pre	T+W
8	1.4.1.1.STQ-18	Pr	18	Ph	2	TL	Ch	Ch	Pre	T
9	1.4.2.1.MCTQ-32	Pr	32	Ph	<1	SL	Ch	Ch	Act	T
10	1.4.3.1.PD-2	Re	2	Ph	<1	TL	Ch	Ch	Pre	T
11	1.6.1.1.MRhI-15	Pr	15	Ph	1	SL	Ch	Ch	Act	W
12	1.8.1.1.SACL-13	Pr	13	Ph	1	TL	Sc	Ch	Pre	T+W
13	1.9.1.1.FOLI-10	Pr	10	Ph	2	TL	Scs	Ch+	Pre	T+W
14	2.1.1.1.CTQ-20	Pr	20	Ph+	3	T+AL	Scs	Ch-	Pre	T+W
15	2.1.1.3.rCTI-11	Re	11	Ph-	2	AL	Scs	Ch-	Pre	T+W
16	2.1.2.1.CAPS-38	En	38	Ph+	3	T+AL	Scs	Ch-	Pre	T+W
17	2.2.1.1.ChQ-16	Pr	16	Ph+	2	TL	Scs	Ch-	Pre	T+W
18	2.2.1.2.SCAS-8	Re	8	Ph-	1	TL	Sc	Ch-	Pre	T+W

(Continued)

**Table 2** (Continued).

#	#.Abbreviation- # of items	2a. Size	2b. Items	3a. Parameter	3b. Scales	4a. Variation	4b. Output	4c. Clock h	5a. Behavior	5b. Interval
19	2.2.2.1.CCQ-16	Fu	16	Ph+	2	TL	Scs	Ch-	Pre	T+W
20	2.3.1.1.CIRENS-3	Pr	3	Ph+	<1	S+AL	Sc	Ch-	Act	W
21	2.4.1.1.MESSI-15	Fu	15	Ph+	3	T+S+AL	Scs	Ch-	Act+Pre	T+W
22	2.5.1.1.MQ-16	Pr	16	Ph+	2	T+SL	Scs	Ch+	Act+Pre	T+W
23	2.5.2.1.SRM-17	Pr	17	Ph-	1	SL	Ch	Ch	Act	T+W
24	2.6.1.1.VJT-19	Pr	19	Ph+	4	S+AL	Scs	Ch+	Act	W
25	2.6.2.1.SIC-1	Pr	1	Ph+	<1	Ty	Na	Ch-	Act	W
26	2.7.1.1.SWPAQ-40	Pr	40	Ph+	5	AL	Scs	Ch-	Pre	T+W+S
27	2.7.1.2.SWPAQ-72	En	72	Ph+	6	AL	Scs	Ch-	Pre	T+W+S
28	2.7.2.1.SWAT-168	Pr	168	Ph+	6	AL	Scs	Ch-	Pre	T+W+S
29	2.7.2.2.rSWAT-60	Re	60	Ph+	6	AL	Scs	Ch-	Pre	T+W+S
30	2.8.1.1.LOCI-38	Pr	38	Ph+	3	T+AL	Scs	Ch+	Pre	T+W

**Notes.** Reduced versions with similar properties were excluded from this table. Moreover, only questionnaires for assessing chronotypes in unspecified adult study participants were included (properties 1a and 1b). Abbreviation for questionnaire properties 2a-5b. 2a. (Questionnaire) size: Pr - primary size (full list of items in primary questionnaire), Fu - full (similar to the primary list of items in secondary questionnaire), Re - reduced (smaller than the primary list of items), and En-enlarged (larger than the primary list of items). 2b. (Number of) items in questionnaire. 3a. (Diurnal rhythm) parameter: Ph - phase parameter, Ph+ - phase and other parameter(s); Ph- - other than phase parameter(s). 3b. (Number of) scales: 1 - number of scales (as sums of items) equal to 1, <1 - single item or three items or non-summed responses (eg., a difference calculated by subtracting one response from another). 4a. (Individual) variation: Ty - type (single item naming chronotype), TL - trait-like, SL - state-like, AL - ability-like, T+AL - trait- and ability-like, T+S+AL - trait-, state- and ability-like, and S+AL - state- and ability-like. 4b. (Assessment) output: Na - names of chronotypes, Sc - score on the only scale/item, Scs - scores on more than one scale, Ch - clock h rather than score. 4c. (Includes) clock h: Ch - clock h in question or answer, or clock h is calculated from several clock h answers, Ch+ - clock h is among answers or questions, and Ch- - clock h is not mentioned in answers and questions. 5a. (Sleep-wake) behavior: Act - actual (current) behavior; Pre - preferred behavior or behavior under specified hypothetical circumstances, Act+Pre - actual and preferred. 5b. Interval (of the sleep-wake cycle): T - interval of sleep-wake and/or wake-sleep transition, W - interval of wakefulness, T+W - both intervals of sleep-wake transition and wakefulness, T+W+S - both these two intervals and sleep interval, T+S - both intervals of sleep-wake transition and sleep (see the last category in Table S4). See also the notes in Tables 1 and S1-S5.

**Table 3** Properties of Scales of Chronotype Questionnaires

#	#.Abbreviation- Number of Items	6a. ME scale(s)	6b. Dimensions	6c. Items	7a. Amplitude/Stability	7b. Items	8a. WakeAbility	8b. Items	9a. SleepAbility	9b. Items
1	1.1.1.1.MEQ-19	ME	>1	19	0	0	0	0	0	0
2	1.1.2.1.rMEQ-1	ME	<1	1	0	0	0	0	0	0
3	1.1.2.2.rMEQ-5	ME	1	5	0	0	0	0	0	0
4	1.2.1.1.DTS-7	ME	>1	7	0	0	0	0	0	0
5	1.3.1.1.CSM-13	ME	>1	13	0	0	0	0	0	0
6	1.3.4.1.MA-5	M	1	5	0	0	0	0	0	0
7	1.3.5.1.PS-12	ME	>1	12	0	0	0	0	0	0
8	1.4.1.1.STQ-18	M,E	<1	3,3	0	0	0	0	0	0
9	1.4.2.1.MCTQ-32	ME	<1	1	0	0	0	0	0	0
10	1.4.3.1.PD-2	ME	<1	1	0	0	0	0	0	0
11	1.6.1.1.MRhl-15	ME	>1	15	0	0	0	0	0	0
12	1.8.1.1.SACL-13	ME	1	13	0	0	0	0	0	0
13	1.9.1.1.FOLI-10	M,E	1	5,5	0	0	0	0	0	0
14	2.1.1.1.CTQ-20	ME	1	6	2	8,5	0	0	0	0
15	2.1.1.3.rCTI-11	0	0	0	2	5,6	0	0	0	0
16	2.1.2.1.CAPS-38	ME	>1	14	2	14,10	0	0	0	0
17	2.2.1.1.ChQ-16	ME	1	8	1	8	0	0	0	0
18	2.2.1.2.SCAS-8	0	0	8	1	8	0	0	0	0
19	2.2.2.1.CCQ-16	ME	1	8	1	8	0	0	0	0
20	2.3.1.1.CIRENS-3	ME	<1	2	0	0	<1	1	0	0

(Continued)

Table 3 (Continued).

#	#.Abbreviation-Number of Items	6a. ME scale(s)	6b. Dimensions	6c. Items	7a. Amplitude/Stability	7b. Items	8a. WakeAbility	8b. Items	9a. SleepAbility	9b. Items
21	2.4.1.1.MESSi-15	M,E	1	5,5	1	5	0	0	0	0
22	2.5.1.1.MQ-16	ME	1	8	1	8	0	0	0	0
23	2.5.2.1.SRM-17	0	0	0	1	17	0	0	0	0
24	2.6.1.1.VJT-19	M,E	1	4,6	0	0	2	5,4	0	0
25	2.6.2.1.SIC-1	ME	<1	<1	0	0	<1	<1	0	0
26	2.7.1.1.SWPAQ-40	M,E	1	12,8	0	0	1	4	2	4,12
27	2.7.1.2.SWPAQ-72	M,E	1	12,12	0	0	2	12,12	2	12,12
28	2.7.2.1.SWAT-168	M,E	1	28,28	0	0	2	28,28	2	28,28
29	2.7.2.2.rSWAT-60	M,E	1	10,10	0	0	2	10,10	2	10,10
30	2.8.1.1.LOCI-38	M,E	1	13,13	0	0	1	1		0

**Notes.** 6a-9b. Abbreviation for questionnaire scale properties. 6a. ME scale(s) (morningness-eveningness scale(s)): ME, one score or clock h or names for chronotype construct, M - one score for morning subconstruct of morningness-eveningness construct, M, E - one score (or clock time) for morning subconstruct and one score (or clock time) for evening subconstruct of morningness-eveningness construct, 0 - no morningness-eveningness scale. 6b. (Number of) dimensions (per ME scales): 1 - one scale - one factorial dimension, >1 - number of factorial dimensions per 1 scale is larger than 1, <1 - single item or three items or non-summed responses (eg., such as a difference calculated by subtracting one response from another), 0 - no morningness-eveningness items. 6c, 7b, 8b, 9b: (Number of) items in such scale(s). 7a. Amplitude/Stability (scale(s)): 1 - one scale - one factor, 2 - two scales - two factors, 0 - no amplitude/stability scales. 8a. Wakeability (scale(s)): 1 - one scale - one factor, 2 - two scales - two factors, <1 - single item, 0 - no wakeability scales. 9a. Sleepability (scale(s)): 2 - two scales - two factors, 0 - no sleepability scales. See also notes to Tables 1, 2 and S1-S5.

Table 4 Number of Chronotype Questionnaires in Each Category of a Property

Property of	Questionnaire						
Property # Its short name	1a. Construct	1b. Group	2a. Size	3a. Parameter	4a. Variation	4b. Output	4c. Clock h
Number Of Categories Of Properties	Ch+ = 15 Ch = 60	- AN = 39 AL = 4 SW = 2 AP = 3 AS = 1 CA = 11	- Pr = 21 Fu = 9 Re = 27 En = 3	- Ph = 38 Ph+ = 15 Ph- = 6	- Ty = 2 TL = 35 SL = 10 AL = 6 S+AL = 2 T+AL = 3 T+S+AL = 2 T+SL = 1	- Na = 1 Sc = 29 Scs = 19 Ch = 9 Ch+Scs = 1	- Ch = 11 Ch+ = 26 Ch- = 23
Total number	75	60	60	60	60	60	60
Property of	Questionnaire		Questionnaire scale(s)				
Property # Its short name	5a. Behavior	5b. Interval	6a. ME scale(s)	6b. Dimensions	7a. Amplitude/ Stability	8a. Wake- ability	9a. Sleep- ability
Number Of Categories Of Properties	- Act = 12 Pre = 25 Act+Pre = 22	- T = 7 W = 7 T+W = 41 T+W+S = 4 T+S = 1	- ME = 41 M = 2 M,E = 11 0 = 6	- 1 = 25 >1 = 23 <1 = 8 0 = 4	- 1 = 11 2 = 4 0 = 45	- 1 = 2 2 = 4 <1 = 2 0 = 52	- 2 = 4 0 = 56
Total number	60	60	60	60	60	60	60

**Notes.** Questionnaires for assessing chronotypes and other constructs were identified (1a) but excluded from further calculations. See Tables S3-S5: 1a. Construct (questionnaire for assessing), Ch+, n = 15). Abbreviation of questionnaire or scale property 1b-9a: Categories (Number of items (2a, 6c, 7b, 8b, 9b) were not included in this table. See also the notes in Tables 1, 2, 3 and Tables S1-S5 for abbreviations.

**Table 5** Example of Comparison of One of the Questionnaires, the MEQ-19, with 29 Other Questionnaires on Similarity (Y) and Difference (N) in Properties

#	#.Abbreviation- # of items	2 a	2 b	3 a	3 b	4 a	4 b	4 c	5 a	5 b	6 a	6 b	6 c	7 a	7 b	8 a	8 b	9 a	9 b	# Y	# N
1	1.1.1.1.MEQ-19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	1.1.2.1.rMEQ-1	N	N	Y	N	N	Y	N	N	N	Y	N	N	Y	Y	Y	Y	Y	Y	11	9
3	1.1.2.2.rMEQ-5	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	16	4
4	1.2.1.1.DTS-7	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	18	2
5	1.3.1.1.CSM-13	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	18	2
6	1.3.4.1.MA-5	N	N	Y	Y	Y	Y	N	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	13	7
7	1.3.5.1.PS-12	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	15	5
8	1.4.1.1.STQ-18	Y	N	Y	N	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	11	9
9	1.4.2.1.MCTQ-32	Y	N	Y	N	N	N	N	N	N	Y	N	N	Y	Y	Y	Y	Y	Y	11	9
10	1.4.3.1.PD-2	N	N	Y	N	Y	N	N	N	N	Y	N	N	Y	Y	Y	Y	Y	Y	11	9
11	1.6.1.1.MRhi-15	Y	N	Y	Y	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	Y	13	7
12	1.8.1.1.SACL-13	Y	N	Y	Y	Y	Y	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	15	5
13	1.9.1.1.FOLI-10	Y	N	Y	N	Y	N	Y	N	Y	N	N	N	Y	Y	Y	Y	Y	Y	13	7
14	2.1.1.1.CTQ-20	Y	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	9	11
15	2.1.1.3.rCTI-11	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	Y	Y	Y	7	13
16	2.1.2.1.CAPS-38	N	N	N	N	N	N	N	N	Y	Y	Y	N	N	N	Y	Y	Y	Y	9	11
17	2.2.1.1.ChQ-16	Y	N	N	N	Y	N	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	10	10
18	2.2.1.2.SCAS-8	N	N	N	Y	Y	Y	N	N	Y	N	N	N	N	N	Y	Y	Y	Y	10	10
19	2.2.2.1.CCQ-16	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	9	11
20	2.3.1.1.CIRENS-3	Y	N	N	N	N	Y	N	N	N	Y	N	N	Y	N	N	I	Y	Y	9	11
21	2.4.1.1.MESSi-15	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	Y	Y	Y	Y	8	12
22	2.5.1.1.MQ-16	Y	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	11	9
23	2.5.2.1.SRM-17	Y	N	N	Y	N	N	N	N	Y	N	N	N	N	N	Y	Y	Y	Y	9	11
24	2.6.1.1.VJT-19	Y	Y	N	N	N	N	Y	N	N	N	N	N	Y	Y	N	N	Y	Y	9	11
25	2.6.2.1.SIC-1	Y	N	N	N	N	N	N	N	N	Y	N	N	Y	Y	N	N	Y	Y	8	12
26	2.7.1.1.SWPAQ-40	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	5	15
27	2.7.1.2.SWPAQ-72	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	4	16
28	2.7.2.1.SWAT-168	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	5	15
29	2.7.2.2.rSWAT-60	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	4	16
30	2.8.1.1.LOCI-38	Y	N	N	N	N	N	Y	N	Y	N	N	N	Y	Y	N	N	Y	Y	9	11

**Notes.** #Y and #N: the sums of the same (Y) and any other (N) categories of 20 properties, 1a-9b (#Y+#N = 20). 1a and 1b are not shown (Y for all 30). See [Table S6](#) for the comparison of the MEQ-19 with all 60 questionnaires for only chronotype assessment.

questionnaires are too long for their inclusion in the main text, only the questionnaires of the 1st category (ie., for unspecified adult populations) were included in tables of the main text (n = 30, [Tables 1–6](#)), while the questionnaires of other categories (ie., addressing specific populations, AL, AP, AS, SW, and CA) were included only in the [supplementary tables](#) (n = 30; [Tables S1–S3](#) and [S5–S7](#) of [Supplementary Materials 1](#)).

2a. Size (of questionnaire). Four categories include primary size (ie., full list of items in primary questionnaire), full-sized (ie., similar to the primary list), reduced size (ie., smaller than the primary or full list), and enlarged (ie., larger than the primary list; abbreviated as Pr, Fu, Re, and En, respectively).

2b. Items (number of questionnaire items). Number of items included in primary or full or reduced or enlarged questionnaire. It varies from 1 to 168.

3a. Parameter (diurnal rhythm parameter). Three categories include phase parameter, phase and other parameter(s), and other than phase parameter(s) (abbreviated as Ph, Ph+, and Ph-, respectively).

3b. Scales (number of questionnaire scales). The number of scales (as sums of items) can be equal to 1 or more. Moreover, either <1 or <3 in the tables refers to insufficient to complete a scale number of items, either single item or

**Table 6** Example of Comparison of One of the Questionnaires, the CTQ-20, with 29 Other Questionnaires on Similarity (Y) and Difference (N) in Properties

#	#.Abbreviation-	2	2	3	3	4	4	4	5	5	6	6	6	7	7	8	8	9	9	#	#
	# of items	a	b	a	b	a	b	c	a	b	a	b	c	a	b	a	b	a	b	Y	N
1	1.1.1.1.MEQ-19	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	Y	Y	Y	8	12
2	1.1.2.1.rMEQ-1	N	N	N	N	N	N	Y	Y	N	Y	N	N	N	N	Y	Y	Y	Y	9	11
3	1.1.2.2.rMEQ-5	N	N	N	N	N	N	N	N	Y	Y	Y	N	N	N	Y	Y	Y	Y	9	11
4	1.2.1.1.DTS-7	Y	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	9	11
5	1.3.1.1.CSM-13	Y	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	9	11
6	1.3.4.1.MA-5	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	Y	Y	Y	Y	8	12
7	1.3.5.1.PS-12	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	10	10
8	1.4.1.1.STQ-18	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	Y	Y	Y	Y	8	12
9	1.4.2.1.MCTQ-32	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	Y	Y	8	12
10	1.4.3.1.PD-2	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	Y	Y	Y	Y	8	12
11	1.6.1.1.MRH-15	Y	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	Y	Y	8	12
12	1.8.1.1.SACL-13	Y	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	11	9
13	1.9.1.1.FOLI-10	Y	N	N	N	N	Y	N	Y	Y	N	Y	N	N	N	Y	Y	Y	Y	11	9
14	2.1.1.1.CTQ-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	2.1.1.3.rCTI-11	N	N	N	N	N	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	Y	Y	11	9
16	2.1.2.1.CAPS-38	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	15	5
17	2.2.1.1.ChQ-16	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	14	6
18	2.2.1.2.SCAS-8	N	N	N	N	N	N	Y	Y	Y	N	N	N	N	N	Y	Y	Y	Y	9	11
19	2.2.2.1.CCQ-16	N	N	Y	N	N	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	13	7
20	2.3.1.1.CIRENS-3	Y	N	Y	N	N	N	Y	N	N	Y	N	N	N	N	N	I	Y	Y	8	12
21	2.4.1.1.MESSI-15	N	N	Y	N	Y	Y	Y	N	Y	N	Y	N	N	N	Y	Y	Y	Y	13	7
22	2.5.1.1.MQ-16	N	N	Y	N	N	Y	N	N	Y	Y	Y	N	N	N	Y	Y	Y	Y	11	9
23	2.5.2.1.SRM-17	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	Y	Y	Y	8	12
24	2.6.1.1.VJT-19	Y	N	Y	N	N	Y	N	N	N	N	Y	N	N	N	N	N	Y	Y	8	12
25	2.6.2.1.SIC-1	Y	N	Y	N	N	N	Y	N	N	Y	N	N	N	N	N	N	Y	Y	8	12
26	2.7.1.1.SWPAQ-40	Y	N	Y	N	N	Y	Y	Y	N	N	Y	N	N	N	N	N	N	N	8	12
27	2.7.1.2.SWPAQ-72	N	N	Y	N	N	Y	Y	Y	N	N	Y	N	N	N	N	N	N	N	7	13
28	2.7.2.1.SWAT-168	Y	N	Y	N	N	Y	Y	Y	N	N	Y	N	N	N	N	N	N	N	8	12
29	2.7.2.2.rSWAT-60	N	N	Y	N	N	Y	Y	Y	N	N	Y	N	N	N	N	N	N	N	7	13
30	2.8.1.1.LOCI-38	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	N	N	N	N	N	Y	Y	12	8

**Notes.** #Y and #N: the sums of the same (Y) and any other (N) categories of 20 properties, 1a-9b (#Y+#N = 20). 1a and 1b are not shown (Y for all 30). See [Table S7](#) for the comparison of the CTQ-20 with all 60 questionnaires for only chronotype assessment.

three items, respectively. Moreover, <1 refers to other calculations than simple summing responses (such as a difference between one response and another response).

4a. Variation (individual variation). The traditional psychological approach to assessment of individual differences includes either typing or ranking along a scale (type vs. trait/state/ability). Therefore, the individuals can be either typed or ranked (with further distinguishing between trait-like, state-like, and ability-like individual variation). Eight categories include type, i.e., naming chronotype by responding to single item (typing), trait-like, state-like, and ability-like individual variation, and their combinations, trait- and ability-like, trait-, state- and ability-like, trait- and state-like, state- and ability-like (abbreviated as Ty, TL, SL, AL, T+AL, T+S+AL, T+SL, and S+AL, respectively).

4b. Outcome (outcome of assessment). Five categories include names of chronotypes on the only scale/item, scores on more than one scale, clock h rather than score, and clock h and scores (abbreviated as Na, Sc, Scs, Ch, and Ch +Scs, respectively).

4c. Clock h (includes clock h in questions and/or answers). Three categories include clock h in question or answer or clock h is calculated from several clock h answers, clock h is among answers or questions, and no clock h among answers and questions (abbreviated as Ch, Ch+, and Ch-, respectively).

5a. Behavior (sleep-wake behavior). Three categories include actual, or, in another term, current behavior, preferred behavior or behavior under specified hypothetical circumstances, and actual and preferred behavior (abbreviated as Act, Pre, and Act+Pre, respectively).

5b. Interval (interval of the sleep-wake cycle). Five categories include time intervals of sleep-wake transition, time interval of wakefulness, both intervals of sleep-wake transition and wakefulness, both these two intervals and sleep interval, and intervals of sleep-wake transition and sleep (abbreviated as T, W, T+W, T+W+S, and T+S, respectively).

The following nine properties were included in the subset of the properties of the questionnaire scales (6a-9b) in addition to the subset of the questionnaire properties (1a-5b; see also [Supplementary Materials](#) for more details):

6a. ME scale(s) (morningness-eveningness scale(s)). Four categories include one score or clock h or names for morningness-eveningness construct, one score for morning subconstruct of morningness-eveningness construct, one score or clock h for evening subconstruct and one score or clock h for evening subconstruct of morningness-eveningness construct, and no morningness-eveningness items (abbreviated as ME, M, M, E, and 0, respectively).

6b. Dimensions (number of dimensions per each of morningness-eveningness scales). Four categories include the following: one scale - one factorial dimension, number of factorial dimensions per 1 scale is larger than 1, single item or three items or non-summed responses, (eg., such as a difference between one response and another response), and no morningness-eveningness scales (1, >1, <1, and 0, respectively).

6c. Items (number of items in morningness-eveningness scale(s)). It varies from 1 to 28.

7a. Amplitude/stability (amplitude/stability scale(s)). Number of scales to assess wakeability or sleepiness varies from <1 to two.

7b. Items (number of items in amplitude/stability scale(s)). It varies from 5 to 17.

8a. Wakeability (wakeability scale(s)). Number of scales to assess wakeability or sleepiness varies from <1 to two.

8b. Items (number of items in wakeability scale(s)). It varies from <1 to 28.

9a. Sleepability (sleepability scale(s)). Two scales were developed to assess sleepability or sleep proneness.

9b. Items (number of items in sleepability scale(s)). It varies from 4 to 28.

## Examples of 11 Properties of Questionnaires

The following questionnaire properties (1a-5b) are illustrated below by properties of some of chronotype questionnaires.

1a. Construct (questionnaire for assessing). Most of the identified questionnaires ( $n = 60$ ) were designed to assess chronotypes. These questionnaires were further categorized in accord with their other 10 properties, 1b-6i ([Tables S2–S5](#)). The remaining questionnaires ( $n = 15$ ) were designed to assess chronotypes in addition to one or more other individual characteristics ([Tables S3–S5](#)). They were not further categorized here due to several reasons. The main reasons for exclusion of these 15 questionnaires designed to assess chronotype and something else from the present classification was that the decisions of choosing such a questionnaire for a given study would require the evaluation of theories behind other than chronotype constructs and specific features of these other constructs. The SCRAM<sup>18</sup> and chrononutrition questionnaires<sup>19–22</sup> can serve as examples of such questionnaires for assessing morning preference and other than chronotype constructs of individual variation.

1b. Group (questionnaire for assessing in study participants). Most questionnaires were developed to assess chronotypes in unspecified adult populations. [Tables 1–3](#) list only such questionnaires, while most of the versions addressing specific populations and the reduced versions of the previously proposed questionnaires are listed only in [Tables S3–S5](#). Overall, a half of 60 identified questionnaires for chronotype assessment were designed to study specific populations and/or were developed by reducing the previously proposed versions. The most recent examples of questionnaires for the assessment of unspecified adults are the MESSi,<sup>11</sup> MRhI,<sup>14</sup> and SIC.<sup>17</sup> The second-largest group of questionnaires include the questionnaires for assessing children and/or adolescents ([Tables S3–S5](#)). The most recent examples of such questionnaires are the MESC<sup>33</sup> and the CCTQ.<sup>34</sup> A minority of the remaining questionnaires targeted other specific populations, such as patients, sportspeople, shiftworkers, and adults speaking languages more or less profoundly distinct from English ([Tables 1–4](#) and [S3–S5](#)). Such questionnaires include the 7-item (reduced) Basic Language Morningness (rBALM) scale,<sup>50</sup> the ASSQ,<sup>13</sup> the 60-item Munich Chronotype Questionnaire for shift workers (MCTQ<sub>Shift</sub>),<sup>51</sup> and the 7-item (shortened Thai version of) Composite Scale of Morningness (sCSM),<sup>52</sup> respectively.

2a. Size (questionnaire size). Some of the initially developed questionnaires were further developed but remained of a similar size in terms of the number of scales and items per each scale (full size  $\approx$  primary size). The examples of primary and secondary questionnaires are the 13-item CSM<sup>7</sup> and the 13-item Basic Language Morningness (BALM),<sup>53</sup> respectively, the 15-item MESSi<sup>11</sup> and the 15-item Morningness-Eveningness-Stability Scale improved for adolescents (aMESSi),<sup>54</sup> respectively, the 16-item Chronotype Questionnaire (ChQ)<sup>9</sup> and the 16-item Caen Chronotype Questionnaire (CCQ),<sup>43</sup> respectively. Some questionnaires were expanded by adding new scales and/or items (Tables 2–4 and S2–S5). The 38-item Circadian Amplitude and Phase Scale (CAPS)<sup>41</sup> was developed from the CTQ<sup>8</sup> and the 6-scale 72-item Sleep-Wake Pattern Assessment Questionnaire (SWPAQ-72)<sup>47</sup> was developed from its primary 5-scale 40-item version.<sup>10,55</sup> More often, a questionnaire was reduced to solve problems of its length, which would often prevent study participants from completing the questionnaire in full (Tables S3–S5). The most popular of the remarkably reduced versions of MEQ<sup>4</sup> is the rMEQ.<sup>32</sup> Another example is the 6-item Ultra-Short Version of the Munich ChronoType Questionnaire ( $\mu$ MCTQ)<sup>56</sup> developed by MCTQ.<sup>31</sup> It was sufficient to obtain the only chronotype measure recommended by the authors of this questionnaire (it is calculated from the reported clock times for sleep). In fact, many research papers cite the MCTQ,<sup>31</sup> but it is unlikely that their authors asked their study participants to answer to each of its 32 questions when they needed for calculation of chronotype to make arithmetic operations on the answers to few questions about sleep times.<sup>31</sup> Moreover, many reductions were aimed at solving two other problems of an earlier developed morningness-eveningness scales, their multi-dimensional structure and the low item-scale correlation coefficients of several questions (Table S2). Such reduced versions of the 19-item MEQ<sup>4</sup> are known as the 15-item (shortened) Morningness-Eveningness Questionnaire (MEQ-15)<sup>57</sup> and the 4-item version of the Morningness-Eveningness Questionnaire (MEQ-4),<sup>58,59</sup> respectively.

2b. Items (number of questionnaire items). However, a reduction in the number of items might decrease reliability of the morningness-eveningness scale. The reliability of the maximally reduced scale, a single-item or three-item measure, cannot be assessed using conventional internal consistency methods, such as Cronbach's alpha. Therefore, they are evaluated using other approaches, such as test-retest reliability, where scale scores, clock times, and type scores are correlated at two different time points. Single-item scales include the SIC<sup>17</sup> and the 19th item of the Morningness-Eveningness Questionnaire (rMEQ-1).<sup>4,60</sup> Moreover, a single clock time can be calculated from the responses to more than one question, for example, by using answers to several items from either MCTQ<sup>31</sup> or  $\mu$ MCTQ.<sup>56</sup>

3a. Parameter (of diurnal rhythm). Starting from the first questionnaire for assessing morningness-eveningness, the MEQ,<sup>4</sup> the majority of published questionnaires were designed to self-assess only one parameter of circadian (diurnal, daily) rhythm, its phase. The list of such questionnaires includes the MEQ,<sup>4</sup> DTS,<sup>5</sup> CSM,<sup>7</sup> MESC,<sup>33</sup> 12-item Early-Late Preferences Scale (PS),<sup>36</sup> and 12-item Student Morningness-Eveningness Questionnaire (SMEQ).<sup>61</sup> A small part of the questionnaires has one or more scales for assessing parameters other than the phase of diurnal rhythm (Tables 1–4 and S3–S5). The list of such questionnaires includes the CTQ,<sup>8</sup> CAPS,<sup>41</sup> SWPAQ,<sup>10,47,55</sup> SWAT,<sup>12,48</sup> ChQ,<sup>9</sup> CCQ,<sup>43</sup> MQ<sup>6</sup> and 17-item Social Rhythm Metric (SRM).<sup>45</sup>

3b. Scales (number of questionnaire scales). Consequently, the authors of the vast majority of chronotype questionnaires developed only scale (Tables S3–S5). The number of scales in the other questionnaires ( $>1$ ) varied from 2 (for instance, the MQ<sup>6</sup>) to 6 (for instance, the enlarged SWPAQ<sup>47</sup> and SWAT<sup>12</sup>). Moreover, chronotype can be assessed using one item with several response options for choosing either a score or name of chronotype (eg., either the MEQ-1<sup>4,60</sup> or SIC,<sup>17</sup> respectively). Chronotype can also be assessed using one continuous variable calculated from the responses to several questions or statements. Such calculation of clock h is the outcomes of the MCTQ<sup>31</sup> and two-item Perfect Day (PD).<sup>38</sup> Moreover, the difference between the scored responses to two questions can be calculated. For instance, the difference between two items is the outcome of the three-item CIRcadian ENergy Scale (CIRENS)<sup>44</sup> that recommends the estimation of morningness-eveningness from responses to morning and evening items.

4a. Variation (individual variation). The traditional psychological approach to assessment of individual differences suggests either typing individuals or ranking them using a scale (type vs. trait/state/ability). Consequently, the individuals can be either typed or ranked (with further distinguishing between trait-like, state-like, and ability-like individual variation). In the SIC,<sup>17</sup> the study participants are directly asked to choose their chronotypes from several names of chronotype. Question(s) designed to rank individuals by assessing trait- and state-like differences between them can refer

either to most typical/usual behavior in such situation/circumstances or to actual (current) situation/circumstances (eg., by asking either about the preference or for today, this week, this month, etc). The PS<sup>36</sup> and SRM<sup>45</sup> are intentionally designed to assess trait-like and state-like individual variation, respectively. One asks about preference while another asks about times for current behavior. Theoretically, an individual's trait-like characteristics are stable, long-lasting, and internally caused, whereas state-like characteristics can be temporal, short-lasting, or caused by external circumstances. In fact, the term "chronotype" can be used only for assessment of trait- and type-like variation, while assessment of current state might disagree with trait- and type-assessment (eg., in the case of administering the questionnaire in atypical/unusual situation/circumstances).<sup>3</sup> Finally, the study participants can be asked about their ability to do something or to perform well or, instead, not quite well during a certain time of the day after a certain – typical or atypical – period of permanent wakefulness or after normal or insufficient sleep or in the sleep-promoting situations. The assessment of ability-like rather than trait-like individual variation was a purpose of the authors of pioneer multi-dimensional questionnaire, the STQ<sup>8</sup> (Tables 1–4 and [S3–S5](#)). The term "adaptability" was coined in this publication to stress that these are the factors determining the success or failure of biological adaptation to night and shift work.<sup>8</sup> Examples of such questionnaires for assessment of ability-like variation include the SWAT,<sup>12</sup> SWPAQ,<sup>10,47,55</sup> and 11-item Circadian Type Inventory-revised (CTI-r).<sup>40</sup>

4b. Outcome (outcome of assessment). Study participants could simply be asked to choose the name of chronotype from several options. The only example is the SIC.<sup>17</sup> The responses to the last (19<sup>th</sup>) question of the MEQ about chronotype (MEQ-1)<sup>4,60</sup> are scored. In the vast majority of questionnaires, the responses to several items are used to calculate a score that determines a position on a scale, for example, in the MEQ.<sup>4</sup> Scores can be calculated on more than one scale, for example, using the CTQ<sup>8</sup> and SWPAQ.<sup>10,47,55</sup> Moreover, clock time can be calculated from responses to several items, for example, by using responses to some of the questions included in the MCTQ<sup>31</sup> and the 18-item Sleep Timing Questionnaire (STQ)<sup>37</sup> (Tables 1–4 and [S2–S5](#)).

4c. Clock h (includes clock hours for questions and/or answers). Clock h can be mentioned in the question(s) and/or answer(s). The 13-item Scale for Assessment of Circadian Lateness (SACL)<sup>39</sup> can serve as an example of a questionnaire intentionally designed to ask exclusively to choose one of several clock h options (each of which is assigned a score) by answering about behavior expected under specified hypothetical circumstances. This makes this morningness-eveningness scale unidimensional despite its relatively long (13-item) length. However, questions and answers can be, in contrast, intentionally worded to avoid any reference to clock times. For instance, the PS<sup>36</sup> asks to compare a study participant with most other people, for example, asking whether you are earlier or later than the other (Tables 1–4 and [S2–S5](#)). Referring to clock hours is also avoided in several other questionnaires, such as the SWAT<sup>12</sup> and SWPAQ.<sup>10,47,55</sup>

5a. Behavior (sleep-wake behavior). One or more items can refer to actual (current) behavior. Such are the questions about actual sleep timing on weekdays and free days in the MCTQ.<sup>31</sup> Moreover, one or more items can refer to preferred behavior or behavior under specified hypothetical circumstances. All items can refer to preferred and hypothetical sleep timing. The example of such questionnaire is the PD<sup>38</sup> (it is asking only about free days). As a rule, items included in a chronotype questionnaire ask either mostly or only about such a preference, eg., either the MEQ<sup>4</sup> or STQ,<sup>37</sup> respectively (Tables 1–4 and [S2–S5](#)).

5b. Interval (interval of sleep-wake cycle). Questions can refer only to the interval of transition from wakefulness to sleep and/or from sleep to wakefulness. Examples of such questionnaires are the PD<sup>38</sup> and the MCTQ.<sup>31</sup> The 5-item Morning Affect factor (MA)<sup>35</sup> asks only about behavior during transition from sleep to wake state. Moreover, scales of a questionnaire can refer to an interval of wakefulness between these transitions, for example, the MRhI.<sup>14</sup> This interval can include a subinterval of prolonged wakefulness. The 19-time point Visuo-verbal Judgment Task (VJT)<sup>46</sup> is designed to ask about sleepiness on the 1.5-day interval of permanent wakefulness after awakening at 7:30. Finally, several items of a scale or even all items of a scale can refer to the interval of night sleep or to the ability to nap during the wake phase of the sleep-wake cycle. The examples of such scales are the nighttime and daytime (or anytime) sleepability scales of the SWAT<sup>12</sup> and SWPAQ<sup>10,47,55</sup> (Tables 1–4 and [S2–S5](#)).

## Examples of 9 Properties of Questionnaire Scales

The following properties of questionnaire scale(s) (6a-9b) are illustrated below by examples of scales of particular chronotype questionnaires.

6a. ME scale(s) (morningness-eveningness scale(s)). Starting with the MEQ,<sup>4</sup> most chronotype questionnaires assess morningness-eveningness with one scale (Tables 1–4 and S2–S5). When the conventional psychometric procedures were applied for construction and/or evaluation of such a scale, they yielded not one, but, at least, two factors. Therefore, starting from the SWPAQ,<sup>10</sup> morning and evening subconstructs of the morningness-eveningness construct were separated in two scales, such questionnaires with two subconstructs developed in separate scales include the MESSi,<sup>11</sup> SWAT,<sup>12</sup> MEEPQ,<sup>15</sup> FOLI,<sup>16</sup> and 38-item Lark-Owl (Chronotype) Indicator (LOCI)<sup>49</sup> (Tables 1–4 and S2–S5). Moreover, it was demonstrated that an original ME scale can be reduced with the purpose of development of a short scale for reliable assessment of just one – morning – subconstruct of morningness-eveningness construct called Morning Affect (MA).<sup>35</sup> This scale's name was later coined to one of two morningness-eveningness scales of the MESSi.<sup>11</sup>

6b. Dimensions (number of dimensions per each of morningness-eveningness scale). Since conventional psychometric procedures were not applied for the construction of initial versions of earlier published ME scales (eg., the MEQ,<sup>4</sup> DTS<sup>5</sup> and CSM<sup>7</sup>), their multidimensional nature was revealed later in studies applying factor analysis for testing their dimensional structure (Table S2). Most usually, the remarkable reduction of an ME scale, for example, to either five or four items, yields a one-factor solution. When a somewhat larger number of items was included in a reduced scale, it remained multidimensional, for example, the 6-item (reduced) Morningness-Eveningness Questionnaire (MEQ-6).<sup>62</sup>

6c. Items (number of items in the morningness-eveningness scale(s)). Although factor analysis of a 4- or 5-item scale, such as the rMEQ,<sup>23</sup> usually yields a single factor, such a scale can contain several constructs that are found in different factors when responses to the primary (much larger) scale, such as the MEQ,<sup>4</sup> are factor-analyzed. Consequently, the application of factor-analytic approach to reduce the number of items can decrease the reliability of a scale because it still contains several constructs of the primary scale (Table S2). Moreover, a questionnaire, such as STQ,<sup>37</sup> can ask to report only three clock times for the calculation of each of the two (morning and evening) components of morningness-eveningness. Such small number of items seems to be insufficient for completing scales.

7a. Amplitude/stability (amplitude/stability scale(s)). The entrained circadian rhythm is characterized by phase and amplitude parameters. It is well established that individual differences in phase parameters are suitable for self-assessment using a morningness-eveningness scale. The development of one or two amplitude/stability scale(s) was encouraged by the idea that psychological and behavioral manifestations of differences in circadian amplitude parameters are also suitable for self-assessments (Table S2). The CTQ,<sup>8</sup> CTI-r,<sup>40</sup> CAPS,<sup>41</sup> ChQ,<sup>9</sup> CCQ,<sup>43</sup> and MESSi<sup>11</sup> contain scale(s) designed to assess the amplitude/stability of diurnal rhythmicity. One of the two scales of the MQ<sup>6</sup> was designed to assess stability of diurnal timing, that is, day-to-day replicable rise- and bed-times. Stability is also assessed with the SRM.<sup>45</sup> One scale for the assessment of the amplitude/stability parameter was developed in MESSi,<sup>11</sup> ChQ,<sup>38</sup> CCQ,<sup>43</sup> the MQ,<sup>6</sup> and SRM,<sup>45</sup> whereas, in contrast, the CTQ<sup>8</sup> and its several descendants, such as the CAPS,<sup>41</sup> the CTI-r,<sup>40</sup> and the 18-item Circadian Type Inventory (CTI),<sup>63</sup> were developed to assess subjective rhythm amplitude by scoring on two scales, languid-vigor and flexible-rigid. It was hypothesized that low-amplitude (eg., languid) and flexible rhythms would show better adjustment to night work. This hypothesis predicted that these scales would be intercorrelated, but the correlation between the established scales was shown to be non-significant (Table S2).

7b. Items (number of items in amplitude/stability scale(s)). Each of amplitude/stability scales contains, at least, 5 items. The minimal length of two scales for assessment of amplitude is equal to 11 items (CTI-r<sup>40</sup>).

8a. Wakeability (wakeability scale(s)). Definitely, people differ in their ability to keep waking in sleep-promoting conditions. Therefore, the ability-like individual variation can be assessed as wakeability under certain conditions without any idea about whether it can be traced to the amplitude parameter of the circadian rhythm (Table S2). Moreover, sleepiness assessed with the VJT<sup>46</sup> seems to be a correlate of wakeability. Wakeability can be assessed using at least two scales (eg., in the SWAT<sup>12,48</sup>) because such ability can manifest in various circumstances (eg., during either appropriate or inappropriate for waking time of the day, in nap-provoking conditions during daytime, in the condition of prolongation of wakefulness to night and next day hours, etc.; Tables 1–4 and S2–S5). For instance, only one

wakeability scale was constructed in the primary version of the SWPAQ,<sup>10</sup> but an additional scale was added to the enlarged version.<sup>47</sup> Moreover, both the primary and reduced versions of the SWAT<sup>12,48</sup> include two wakeability scales. Finally, the VJT<sup>46</sup> assesses sleepiness levels during hours of everyday wakefulness that include typical hours of nap and during the following prolongation of wakefulness on hours of everyday sleep.

8b. Items (number of items in wakeability scale(s)). Alertness-sleepiness or wakeability during usual interval of wakefulness might be assessed not only with a scale, as in the VJT,<sup>46</sup> SWAT<sup>12,48</sup> and SWPAQ<sup>10,47,55</sup> but also with the single question of the SIC<sup>17</sup> asking about the pattern of daily variation in alertness-sleepiness level (<1 scale).

9a. Sleepability (sleepability scale or scales). Two opposing terms, “wakeability” and “sleepability”, can describe sleep-wake behavior at different times of the day and after different periods of permanent wakefulness or sleep. Factor analysis of wakeability and sleepability items suggested that they cannot be assigned to opposing poles of a single factorial dimension. For instance, a study participant can report that it is easy for him/her not only to remain awake but also to fall asleep, while another participant can have problems with both waking and falling asleep. Therefore, results of factor analysis were used to identify the items of factorial dimensions of wakeability and sleepability that were included in separate wakeability and sleepability scales of the SWAT<sup>12,48</sup> and SWPAQ<sup>10,47,55</sup> (Tables S2–S4).

9b. Items (number of items on the sleepability scale or scales). The four-items scales of the primary version of the SWPAQ<sup>10</sup> were further developed in 12-item scales.<sup>47</sup> The 10-item scales are included in the reduced version of the SWAT.<sup>48</sup>

## Examples of Comparison of Properties of Questionnaires

Properties of questionnaires listed in Tables S3 and S4 can be used for the comparison of each of chronotype questionnaires with other 59 questionnaires on 11 questionnaire properties and 9 properties of their scales (20 in total). Tables S6–S7 and S5 and S6 illustrate such comparison for the pioneer questionnaires proposed for self-assessment of morningness-eveningness and sleep-wake adaptabilities, the MEQ<sup>4</sup> (Tables S6 and 5) and the CTQ,<sup>8</sup> respectively (Tables S7 and 6). Such tables can be made for comparison of any of remaining 58 questionnaires with other questionnaires.

The publication of the MEQ<sup>4</sup> encouraged development of several similar questionnaires that were found to differ from it in only two of 20 properties, the 7-item DTS,<sup>5</sup> the 13-item CSM,<sup>7</sup> the 19-item caMEQ,<sup>64</sup> and the 19-item aMEQ<sup>65</sup> (Tables S6 and 5). Most of the MEQ’s properties are also very similar to the properties of other questionnaires for assessment of phase parameter of diurnal rhythm, but they are much more dissimilar to the properties of questionnaires for multidimensional assessment of chronotype (Tables S6 and 5). Most profound differences (in 15 or 16 properties) are shown by the questionnaires with 5 or more scales (Tables S6 and 5).

The properties of the CTQ<sup>8</sup> are rather dissimilar to the properties of the majority of other questionnaires (Tables S7 and 6). This questionnaire differs in 9–13 properties from questionnaires for assessment of phase parameter of diurnal rhythm, and it shows rather similar number of differences from properties of the majority of questionnaires designed for multidimensional assessment of chronotype (Tables S7 and 6).

## Discussion

The number and variety of chronotype questionnaires have profoundly increased over the last 50 years, after the first publication of such a questionnaire.<sup>4</sup> It is sometimes essential to determine which of these questionnaires would be better applicable for answering a given research question. Here, a structured system is proposed to 1) facilitate comparisons of the properties of chronotype questionnaires and 2) predict the features of unconstructed questionnaires and scales. A set of 20 chronotype questionnaire properties was defined, and 60 questionnaires were classified to provide the possibility to distinguish each of them from 59 other questionnaires. Thus, the results suggested that the relationships and conceptual and methodological differences between numerous chronotype questionnaires and scales can be clarified in the framework of a single structured system. This system can help navigate between numerous questionnaires without much effort, for example, without inspecting the content of each questionnaire. It might be used to choose the right instrument for a study of individual differences in the domain of chronobiology and sleep science. Moreover, it can also help to develop new questionnaires and new versions of previously published questionnaires. The prospects of such application of the proposed system are illustrated below.

The prediction of content of scales of an extended version of the VJT can illustrate applicability of the proposed structured system for developing new versions of previously published questionnaires. The 19-time point VJT asks study participants to score the expected level of sleepiness at 19 different clock times within a 1.5-day interval of permanent wakefulness. Originally, the VJT<sup>46</sup> was constructed to validate flexibility scores obtained with the CTI,<sup>62</sup> and, in a more recent studies, it was applied for the validation of chronotypes self-chosen with the SIC<sup>17</sup> and to support the structural model of sleep-wake ability with 6 factorial dimensions.<sup>48</sup> Four scales revealed by factor analysis of the VJT<sup>17</sup> were compared with 6-scales of SWPAQ<sup>47</sup> and SWAT<sup>48</sup> and these results can illustrate the possibility to predict the method of extension of the VJT. It was shown<sup>48</sup> that these 4 scales are the counterparts of 4 of 6 scales of SWPAQ<sup>47</sup> because the SWAT<sup>48</sup> is designed to assess wakeability in the morning, daytime, nighttime and next morning hours (ie., Morning Lateness, Daytime Wakeability, Evening Lateness and Anytime Wakeability of the SWPAQ,<sup>47</sup> respectively, and Morning Sleepability, Daytime Wakeability, Nighttime Wakeability, and After 24 h Wakeability of the SWAT, respectively<sup>48</sup>). Because sleepiness is a correlate of wakeability rather than sleepability, the VJT cannot be used for assessing sleepability/sleep proneness at different clock times during this 1.5-day interval of permanent wakefulness. The structural model of sleep-wake ability predicts 6 factorial dimensions developed in 6 scales of the SWPAQ<sup>47</sup> and SWAT.<sup>48</sup> Therefore, the VJT can be enlarged to additionally assess sleepability/sleep proneness with two scales. For instance, 19 primary questions about how study participants think they would be sleepy at 19 clock times can be modified in 19 new questions asking about how easy study participants think they would fall asleep. The response options can distinguish between more or less longer time intervals required to voluntarily fall asleep (eg., less than one min, 1–5 min, 6–10 min, 11–30 min, >30 min, and failure to sleep).

It is expected that factor analysis of the proposed enlarged (38-item) version of the VJT would yield two additional factors, a factor of sleepability/sleep proneness expected during usual interval of everyday wakefulness (eg., daytime sleepability/sleep proneness) and a factor of sleepability/sleep proneness expected during the following interval of extended wakefulness (eg., nighttime sleepability/sleep proneness). These factors are predicted to become the counterparts of two remaining factors of SWPAQ<sup>47</sup> and SWAT<sup>48</sup> represented by Anytime Sleepability and Nighttime Sleepability scales in the SWPAQ, respectively, and Daytime Sleepability and Nighttime Sleepability scales in the SWAT, respectively.

Overall, the analysis of the proposed extended version of the VJT would yield 6 factors. Four factors are predicted to be the same as 4 factors of the original 19-item version (sleepiness in the morning, daytime, nighttime and next morning hours), while the additional items would mostly load on two more factors (daytime and nighttime sleepability/sleep proneness). Consequently, similarly to the SWPAQ<sup>47</sup> and SWAT,<sup>48</sup> the extended 38-item version would include 6 scales for assessing wakeability/sleepiness and sleepability/sleep proneness. Thus, this proposal illustrates the possibility of uncovering empty territories in the questionnaire landscape to predict properties of yet-unconstructed questionnaires and scales.

Studies on age-associated differences in morningness-eveningness can illustrate the importance of choosing an optimal questionnaire tool for research on individual variation in the field of chronobiology and sleep science. It is well established that sleep duration gradually decreases with advancing age,<sup>66,67</sup> while circadian sleep timing shows a clear n-shape age trend with the most prominent delay of bedtime in the age of late adolescence and early adulthood. In other words, age-associated shifts occur toward later and earlier sleep timing during the transitions through adolescence and then through adulthood, respectively.<sup>31,68,69</sup> Irrespective of age, the difference in sleep timing between the morning and evening types was found to be approximately equal to two hours.<sup>70</sup> Since sleep duration and timing dramatically varies with age, morning types identified in a sample of late adolescents usually report weekend wakeups at the same clock time as evening types in samples of people of younger and older ages (that is, early adolescents and middle-age adults, respectively).<sup>64,70,71</sup> Moreover, when both morning and evening types are forced to wake up on weekdays at approximately the same clock time to attend the same workplace or class, the difference between them in weekend sleep timing becomes much shorter than two hours due to a more pronounced shift of the 24-h pattern of weekday light exposure in the evening than morning types.<sup>65</sup>

Such issues of comparison of current (within this week) sleep timing in chronotypes of different ages, even under identical environmental conditions, were recognized by the authors of some questionnaires, such as the PS<sup>36</sup> and SWPAQ.<sup>10</sup> These questionnaire tools do not mention clock times in any of items and any response options. Consequently, such questionnaires, rather than questionnaires asking about actual or even preferred clock times, can

be recommended for the comparison of chronotypes of participants of various ages and for the comparison of people living in northern and equatorial countries.<sup>3</sup> Moreover, as discussed in,<sup>23</sup> profoundly different results of the comparison of chronotypes might be obtained in studies applying questionnaires asking about either actual (current) or preferred clock time, i.e., designed to assess state- and trait-like individual variation, respectively.

There are limitations to the set of classified questionnaires and the proposed approach to their classification. Only the questionnaires designed to assess chronotype were classified here using the proposed 20 properties. The questionnaires for assessment of chronotype and other constructs can be also, at least partially, accommodated within the proposed system in further studies. Further studies are definitely needed to check replicability of the proposed classification system. This is a single-author classification that desires confirmation by independently suggested classification. A property-based classification system does not exclude the necessity for future development of classification based on other approaches (eg., such as a decision algorithm, a scoring tool, an interactive selection guide, etc). Moreover, the proposed system does rely on some important information about each of classified questionnaires, such as its validity and reliability, reproducibility of the questionnaire-based results, attempts of its translation/localization/cross-cultural adaptations, etc.

## Conclusion

The system of questionnaire classification based on a set of 20 questionnaire and questionnaire scale properties was proposed. It can help in navigating between numerous published questionnaires. This system might be used for 1) choosing an optimal instrument for assessment of individual chronobiological differences and 2) predicting properties of new questionnaires and scales. These possibilities were illustrated in Discussion on the examples of 1) choosing right questionnaire for age-associated research and 2) predicting factorial structure of an enlarged version of the published questionnaire. Further studies are needed to check replicability of the proposed classification system and to examine its predictive power for construction of new questionnaires or scales. Further development of this classification can be, in particular, aimed on accounting for several additional features of chronotype questionnaires, such as their validity and replicability, attempts of their translation/localization/cross-cultural adaptations, and results of their direct comparison as the instruments for achieving a particular research purpose.

## Supplementary Materials

[Supplementary Materials 1](#) include [Tables S1–S7](#), and [Supplementary Materials 2](#) include Code-book: Decision Rules for the 20 Properties.

## Preprint

This article has been uploaded to Preprints.org as a preprint: <https://doi.org/10.20944/preprints202601.0929.v2> (Posted Date: 13 February 2026).

## Data Sharing Statement

No new datasets were generated for this study. The data supporting the reported results can be found in [Tables S1–S4](#) of the [Supplementary Materials 1](#).

## Author Contributions

A.A.P is the only author of this paper: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, and Writing – review and editing. The Author gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

## Funding

This research received no external funding.

## Disclosure

The author reports no conflicts of interest in this work.

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